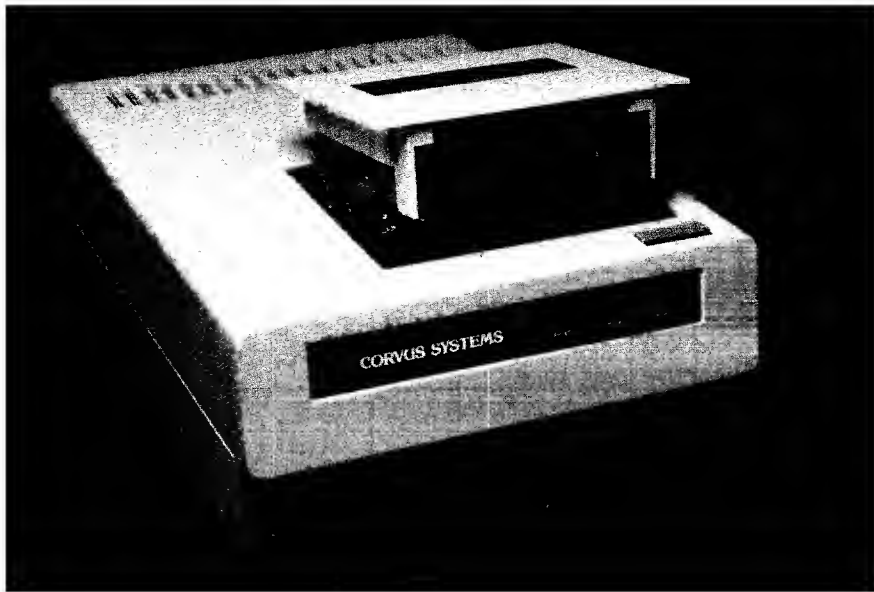


# THE CORVUS SERVICE MANUAL



The Bank™

✧✧ CORVUS SYSTEMS

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**CORVUS SYSTEMS  
THE BANK  
SERVICE MANUAL**

PART NO.: 7100-05219

RELEASE DATE: 15 MARCH 1984

This document contain three types of notations. These are, in increasing order of importance, *NOTE*, **CAUTION**, and **WARNING**. The *NOTE* indicates some action to be taken to speed or simplify a procedure. The **CAUTION** indicates that pontential damage to the equipment or user data exists, and care should be taken to avoid this. The **WARNING** indicates that potential harm or injury to the service technician or operator exists, and extreme care should be taken to avoid these.

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## **CORVUS DEALER SERVICE**

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## **SPECIFICATIONS**

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## SPECIFICATIONS

<b>Cabinet</b>	Depth 16.0 inches / 40.64 cm
Width	12.0 inches / 30.5 cm
Height	5.75 inches / 14.6 cm
Weight	19 lbs / 8.5 kg (no cartridge)
Top Loading	

<b>Tape Drive</b>	
Tape Speed	18 feet / 5.5 meters per second
Recording Format	Modified Frequency Modulation
Data Transfer	1 million bits per second
Data Density	4620 bits per inch
Number of Tracks	101
Available to User	99
Reserved Firmware	1
Landing	1
Track Density	254 tracks per inch
Track pitch	100 micrometers
Seektime:	
1 track	20 milliseconds per track
Latency	
100-MB Tape	12 seconds
200-MB Tape	21 seconds
Settling time	300 milliseconds
Interface	Corvus OMNINET™
MTBF	1500 hours
MTTR	30 minutes

<b>Data Integrity</b>	
Soft errors	1 in 1 X 10 <sup>8</sup> bits
Hard errors	1 in 1 X 10 <sup>11</sup> bits

<b>Format</b>	
Soft sector	4 or 8 logical tracks per physical track
256 Sectors	per logical track
4 Spare sectors	per physical track

<b>Power</b>	
100/110 or 220/240 VAC,	50-60 Hz

<b>Environmental</b>	
<b>Operating</b>	
Temperature	41°F to 90°F / 5°C to 32°C
Relative Humidity	30% to 80%
Altitude	0 to 10000 feet / 0 to 3050 meters
<b>Storage</b>	
Temperature	32°F to 122°F / 0°C to 50°C
Relative humidity	10% to 85%

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## CORVUS DEALER SERVICE

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### **Tape Cartridge**

Tape Width	1/2 inch / 12.7 mm
Tape length:	
100-MB	173.7 feet / 53 meters
200-MB	337.8 feet / 103 meters
Tape loop time:	
100-MB	9.7 seconds
200-MB	18.8 seconds
Memory capacity:	
100-MB	
unformatted	1.14 MB per track
formatted	1.03 MB per track
200-MB	
unformatted	2.28 MB per track
formatted	2.07 MB per track
Depth	5.5 inches / 140 mm
Width	5.5 inches / 140 mm
Height	1.5 inches / 36 mm
Weight	
100-MB	9.34 ounces / 265 grams
200-MB	10.05 ounces / 285 grams
Tape life	500 hours spinning
	500 starts/stops

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## **CORVUS DEALER SERVICE**

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### **CHAPTER 1**

### **GENERAL DESCRIPTION**

## CHAPTER 1 GENERAL DESCRIPTION

### 1.0 Scope of Chapter

This chapter provides an overall view of the Bank. Its use, major assemblies, and external features are described. Receiving instructions and a summary of installation procedures are given. The chapter concludes with a description of the Bank tape cartridges and their care and storage.

### 1.1 Introduction

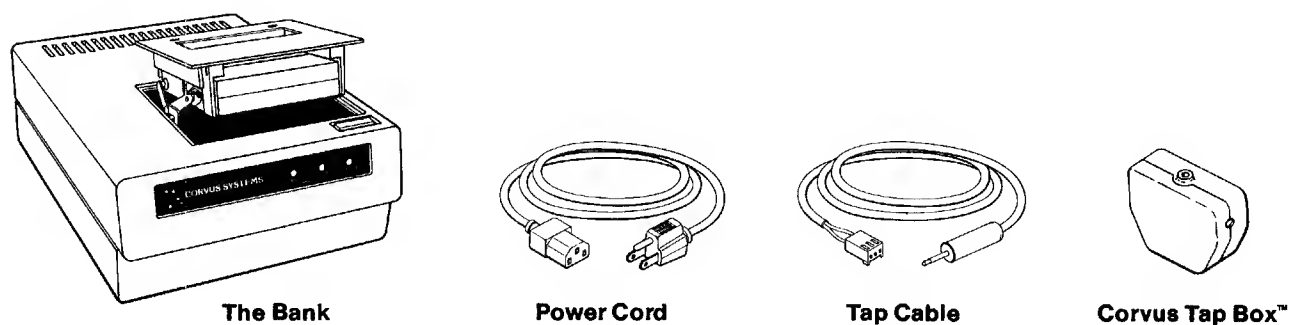
The Bank Service Manual is designed for service technicians who perform maintenance or warranty service on the Corvus Bank. For ease of maintenance the Bank has been designed as a group of replaceable modules. Corvus recommends that service be limited to module replacement and to maintenance procedures described in this manual.

### 1.2 General Description

The Bank is a continuous loop tape drive primarily designed as an archival backup device for the Corvus OMNINET Local Area Network. The recording tape is safely housed in a removable cartridge. A single read/write head can be positioned vertically at 101 locations, called tracks, on the tape.

### 1.3 Receiving the Bank

The Bank installation package should contain five items: the Bank, an AC power cord, one OMNINET tap cable, one OMNINET tap box, and a manual. Tape cartridges are purchased separately.



**Figure 1-1. Bank Installation Package**

The Bank should be carefully unpacked and checked for shipping damage. External evidence of rough handling may be symptomatic of damage to the delicate mechanisms within the device.

**NOTE:**

*Any damage claims must be reported to the local office of the shipper so an inspection may be made, and a damage report filed. If the damaged equipment is a new product, the Corvus Order Processing Department must be contacted for proper return procedures. If the damaged equipment is a recently serviced product being returned under an RMA (Return Merchandise Authorization) number, contact the Corvus Customer Service Department for proper return procedures.*

The Bank is manufactured in two models; one for use with 100-110 VAC, the other for use with 220-240 VAC. The voltage rating is written on the metallic serial number label on the rear of the cabinet. If the voltage rating is not compatible with the local voltage, contact your Corvus dealer.

#### 1.4 Major Assemblies

The Bank is comprised of five modular units. These are:

- Tape Drive Mechanism
- OMNINET Bank Controller Board
- Read/Write CPU Board
- Servo Board
- Power Supply

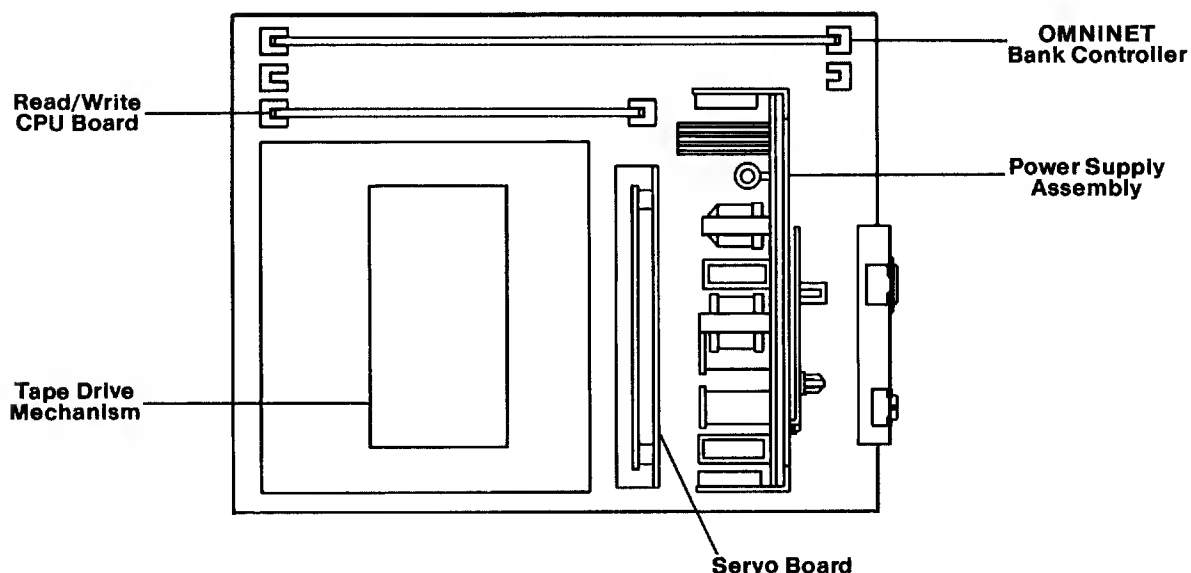


Figure 1-2. Major Assemblies

Each is replaceable as an individual module for ease of service.

##### 1.4.1 Tape Drive Mechanism

Manufactured for Corvus by Tokyo Electric Corporation, the tape drive mechanism can be divided into functional subassemblies:

- Tape Cartridge Holder and Support Assembly
- Read/Write Head and Tracking Unit
- Stepper Motor
- Capstan and Servo Motor
- Tape Load Solenoid
- Sensor Switches

These subassemblies are described in section 2.2

#### 1.4.2 OMNINET Bank Controller Board

The Transporter, Disk Server, and Tape Controller are the three functional areas of the OMNINET Bank Controller. This board, the largest of all the Bank's PCA's, is positioned parallel to the cabinet sides nearest the left side when viewed from the front of the Bank. Section 2.3 of this manual provides a functional description of this board.

#### 1.4.3 Read/Write CPU Board

Mounted between the OMNINET Controller and the tape drive mechanism, the Read/Write functions and mechanical operations controlled by this board are described in section 2.4.

#### 1.4.4 Servo Board

The servo board drives the tape servo motor. This small board is mounted between the power supply board and the tape drive mechanism. The servo board function is discussed in section 2.5.

#### 1.4.5 Power Supply

A single power supply provides all DC voltages used by the Bank. The power supply is the rearmost assembly inside the cabinet, adjacent to the AC power supply plate. Section 2.6 details the power supply and fuse.

#### 1.5 Switches and Indicators

Switches, buttons, and indicators used in normal operation are located on the outside of the cabinet to provide user access.

##### 1.5.1 LED Indicators

There are three indicator Light Emitting Diodes (LED's) on the front panel of the Bank; READY, BUSY, and FAULT. After the system has come ready as described in section 1.6 the READY light only will be on. Section 6.2 gives details of the possible indicator light combinations and associated conditions.

##### 1.5.2 Tape Eject Button

The tape eject button is on the top of the Bank cabinet just in front of the tape cartridge holder. This is used to open the tape cartridge holder to install a cartridge or to remove a cartridge.

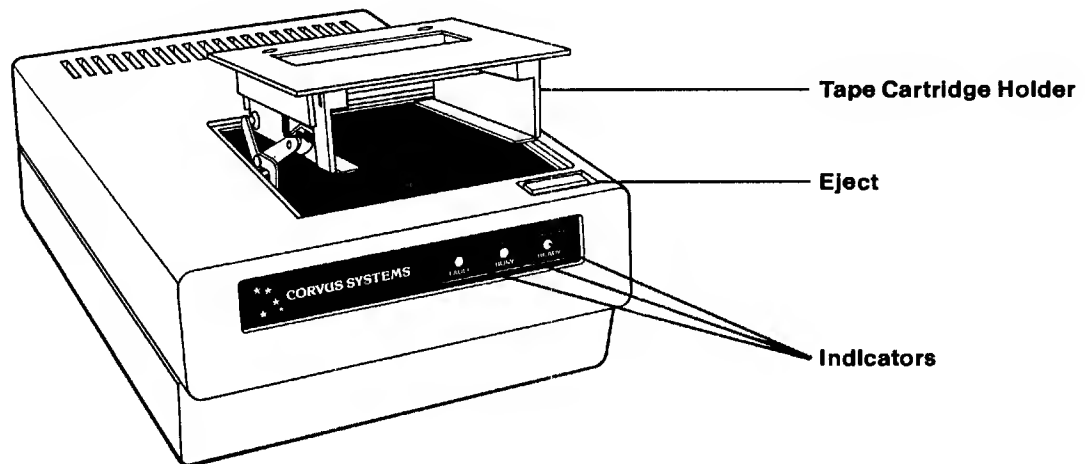


Figure 1-3. Bank Front View



### 1.5.3 RESET Switch

The power to the Bank should not be turned off while the tape servo motor is running nor should a tape cartridge be removed. Normally the motor will stop within 60 seconds after the last command; the servo motor audibly stops and the tape solenoids (see section 2.2.5) can be heard to disengage.

Should the motor fail to stop, the RESET button may be used to disengage the servo motor. The RESET button is the small round button on the rear panel between the power socket and power switch. Press the RESET button. When the servo motor has stopped and the solenoids have disengaged, the tape may be ejected or the power turned off.

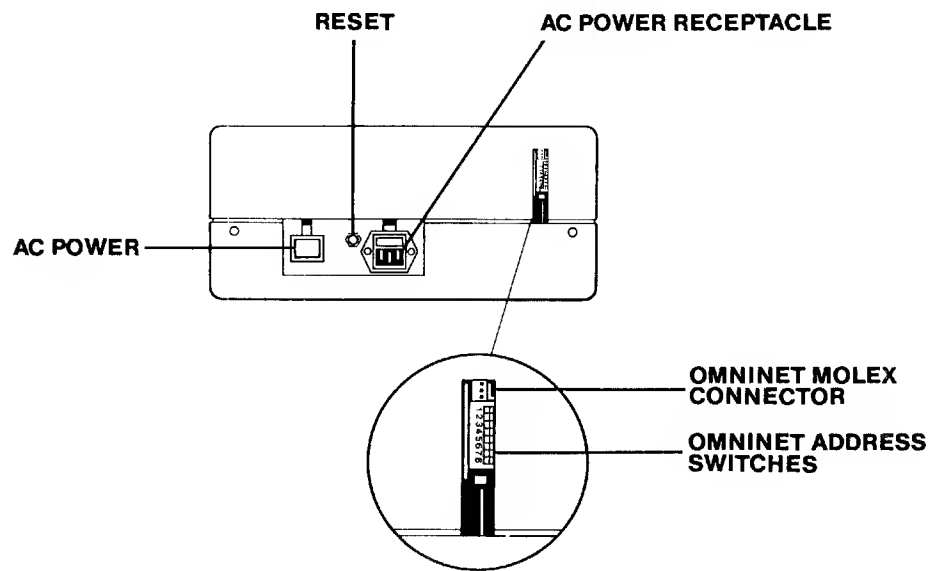


Figure 1-4. Bank Rear View

### 1.5.4 Network Address Switches

Each network device must have a unique "address." For the Bank, this is done by setting the eight microswitches, DIP switches, on the rear of the Bank, immediately below the OMNINET connector. Choose an address from 1 to 63; 0 is reserved for the OMNINET Disk Server. Set switches 1 to 6 to correspond to the selected address. Switches 7 and 8 should both be set OFF or OPEN.

A table of switch settings for each address can be found in The Bank Guide or the OMNINET Installation Guide.

### 1.6 Installation

To install the BANK:

1. Install the OMNINET tap box at the desired location on the trunk line. Leave a minimum of 5 feet (1.5 meters) between tap boxes on the trunk.
2. Set the OMNINET address.
3. Plug the phono-jack end of the tap cable into the tap box; plug the other end into the Molex connector on the rear of the BANK.

4. Attach the AC power cord to the Bank and then to the power outlet.
5. Turn on the Bank's power switch on the rear of the cabinet.
6. Place a tape cartridge in the holder and close the holder.

The tape load solenoid will cause the pinch roller to hold the tape against the capstan and place the tape across the head assembly. The head will seek to track 0 and the tape will spin-up to speed. When a tape correctly configured for use is in place, the BUSY LED will go on for approximately 30 seconds, then only the READY LED will remain on. (Instructions for formatting a tape may be found in the Bank Guide.) If the Bank does not come ready, see the discussion of the LED indicators in section 6.2.

Complete instructions for the installation and use of the Bank can be found in the following manuals:

- The Bank Guide
- Transfer Utility Manager's Guide

### 1.7 Bank Cartridges

Bank tapes are available in 100 and 200-megabyte (abbreviated MB) capacities. Tape specifications are given in Table 1-1.

Memory Capacity	Tape Length	Tape Loop Time
200-MB	103 Meters	18.8 $\pm$ .4 Sec
100-MB	53 Meters	9.7 $\pm$ .3 Sec

**Table 1-1. Cartridge Tape Specifications**

#### 1.7.1 Tape Tracks

There are 101 tracks on a tape. Track 0, or the landing track, is the track to which the head is moved at power-up. Firmware is resident on track 1 and the remaining tracks, 2 to 100, are used for data storage.

Each tape is divided into segments or "heads." Each head is composed of 256 sectors. There are 4 heads on a 100-MB tape and 8 heads on a 200-MB tape.

Four sectors are reserved on all tapes for spares in the event of tape defects; this yields a total of 1020 user sectors on a 100-MB tape and 2044 user sector in 200-MB tape. If a defective sector is found, one of the spare sectors may be used as a substitute.

The table below provides a quick reference of these specifications.

Capacity	Segments or Heads	Sectors Per Head	Sectors Per Track	Bytes Per Sector	Spare Tracks- Sectors
100 MB	4	256	1020	1024	4
200 MB	8	256	2044	1024	4

**Table 1-2. Tape Specification Table**

**1.7.2 Care and Storage of Tapes**

Like any magnetic recording medium, Bank tapes require careful handling and storage.

- Never touch the tape surface.
- Never disassemble a tape cartridge.
- Store each cartridge in its protective sleeve when not in use.

**CAUTION:**

**Moisture may condense on the tape if the cartridge is brought into a warm room from the cold outdoors during the winter. This moisture can cause damage to the tape or the Bank mechanism. Let the cartridge warm up to room temperature before using it.**

- To prevent accidental erasure of a tape, remove the "break-out" tab on the bottom corner of the cartridge; the tape may not then be used to record. To again use the cartridge for recording, cover the hole with a piece of cellophane tape.



Figure 1-5. Tape Break-Out Tab

**CHAPTER 2**  
**FUNCTIONAL DESCRIPTION**

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## CHAPTER 2

### FUNCTIONAL DESCRIPTION

#### 2.0 Scope of Chapter

This chapter provides a functional description for the Bank hardware. Presented first will be a general block diagram of the major assemblies followed by detailed circuit descriptions. Corvus recommends that troubleshooting be limited to exchange of one of the failing major assemblies or adjustments as outlined in chapter 5.

Included in this chapter are detailed circuit descriptions to assist qualified technicians in functional understanding of the Bank to a discrete component level. This is for informational purposes only; PERFORMING COMPONENT LEVEL REPAIR MAY VOID THE WARRANTY ON THE BANK.

#### 2.1 Introduction

As shown in figure 2-1, the Bank is made up of five major assemblies. In servicing the Bank these five assemblies are replaceable modules. The three LEDs on the front panel of the Bank are mounted to a paddleboard. The LEDs are not individually replaceable, but the paddleboard can be replaced.

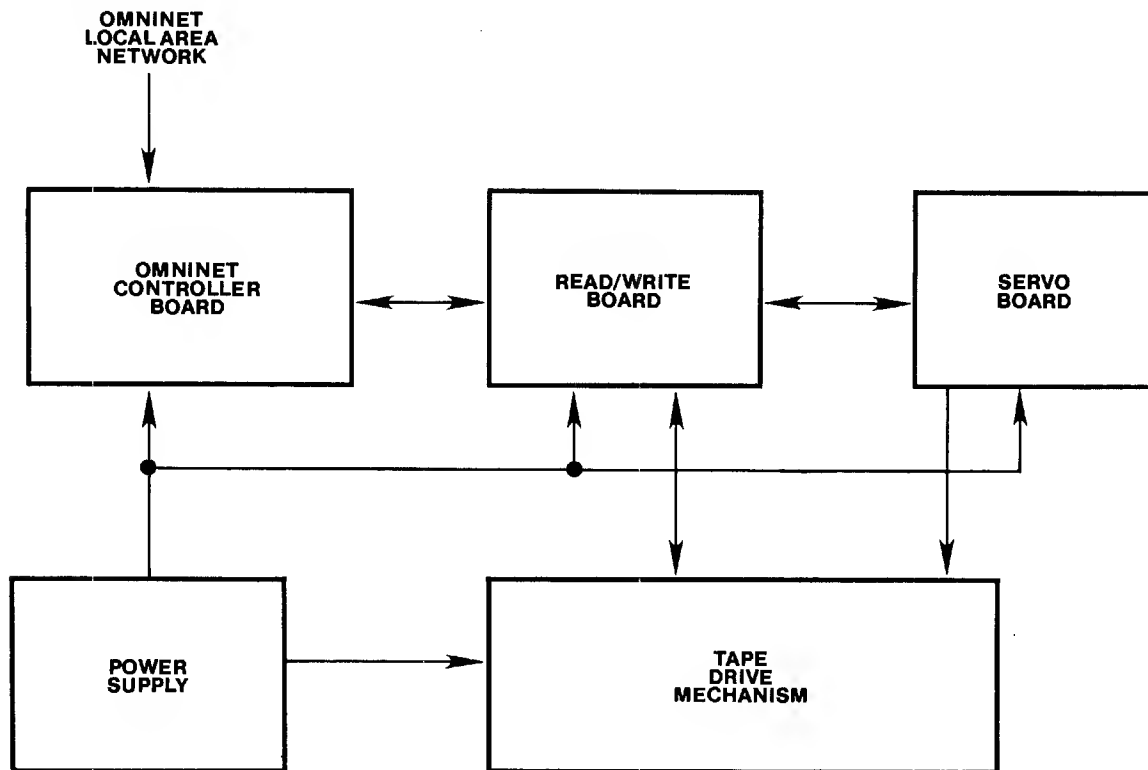


Figure 2-1. Bank Block Diagram

#### 2.2 Tape Drive Mechanism

The tape mechanism is manufactured by Tokyo Electric Corporation to Corvus specifications. All moving parts of the Bank are contained within this assembly. Its purpose is to: 1) guide the tape cartridge during loading and ejecting, 2) sense for a loaded cartridge, 3) sense for a write protected cartridge, 4) load the tape against the capstan and read/write head, 5) move the tape, 6) move the read/write head to a specified track, and 7) read/write data on the tape.

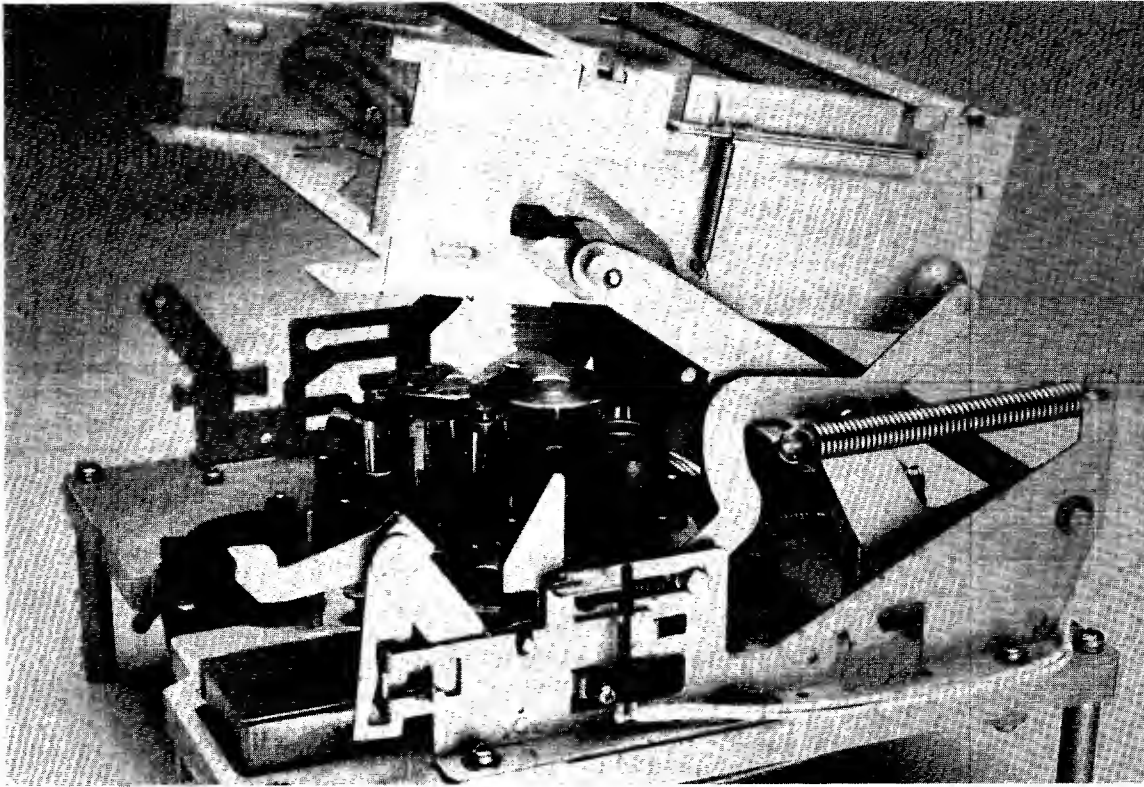


Figure 2-2. Tape Drive Mechanism

#### 2.2.1 Cartridge Holder Assembly

The cartridge holder is simply a mechanical device which loads and ejects the tape cartridge. Springs, levers, and the metal frame are designed for special Bank cartridges only. A leaf switch on the holder's right side (when viewed from the front) is a sensor for loading and ejecting cartridges.

#### 2.2.2 Read/Write Head

A single read/write head is mounted on the head positioner assembly. Like most recording heads it is made of a set of induction coils which produce and detect magnetic fields. During write operations a frequency modulated signal is sent through the coils and is recorded on the surface of the tape as it moves past the head. During read operations the same set of coils detect the recorded signal and passes it to the Read/Write CPU board.

#### 2.2.3 Head Tracking Unit and Stepper Motor

The head tracking Unit positions the head over the appropriate track of the tape. The positioner is composed of a stepper motor, gear train, sensor, and worm gear. The read/write head is moved vertically by rotation of the worm gear. The stepper motor, located under the tape drive, turns the worm gear via one idler gear and simultaneously turns two other gears which are used to sense the track zero position. Counterclockwise rotation of the worm gear moves the head down towards track zero, while clockwise rotation moves the head upward toward track 100.

#### 2.2.4 Servo Motor and Capstan

The capstan is a precision roller which controls movement of the tape. The capstan is driven directly by the drive servo motor located on the underside of the capstan. The tape is held against the capstan by a pinch roller. A felt brake pad stops the capstan after each tape movement operation.

### **2.2.5 Pinch Roller or Tape Load Solenoid**

The pinch roller solenoid, also called the tape load solenoid, operates after a tape cartridge is inserted. It causes the pinch roller to hold the tape against the capstan, while at the same time it disengages the capstan brake. The solenoid is controlled by circuitry located on the Read/Write CPU board. No field adjustments can be made to the solenoid or associated levers.

### **2.2.6 Unload Solenoid**

Activated when the servo motor stop signal is generated, the unload solenoid controls the tape position as the tape is stopped.

### **2.2.7 Tape Hold or Tape Curb Solenoid**

The tape hold or tape curb solenoid is located at the rear of the mechanism assembly. It ensures that the tape is properly aligned while spinning. It also ensures proper tension and reduces tape slack when stopping. A tamper pad, located inside the tape cartridge, is activated by a lever which projects up into the cartridge when the cartridge is loaded into the drive.

### **2.2.8 Sensor Switches**

There are three switches associated with the tape mechanism. One is located on the cartridge holder assembly while the other two are located at the rear of the mechanism assembly. The cartridge detect switch, located on the side of the cartridge holder is used to disable tape operations while loading or ejecting a cartridge. The other two switches, located at the rear of the mechanism, sense for a properly loaded cartridge and for a write protected cartridge.

## **2.3 OMNINET Bank Controller Assembly**

The OMNINET Bank Controller is an intelligent controller which interfaces the Bank to the Corvus OMNINET. It supports all commands which are implemented on a Corvus Winchester Drive. The Bank OMNINET Controller can be divided into three main functions:

- OMNINET Transporter
- Disk Server
- Tape Controller

This board has 10K x 8 bits of static RAM which is contained in 5 socketed chips. The RAM is shared for the three main functions listed above. 2K is used by the disk server and 2K for the tape controller buffer. The remaining 6K is utilized by the 6801 microprocessor which is part of the OMNINET transporter.

### **2.3.1 OMNINET Transporter**

The transporter section of the controller board utilizes the standard OMNINET chip set:

- 6801 Microprocessor
- Corvus Monochip
- Advanced Data Link Controller
- RS422 Transmitter and Receiver

The MC6801 is the heart of the OMNINET chip set. It is an 8-bit, single-chip microprocessor which contains a 2K X 8 bits internal ROM and internal RAM of 128 bytes. The MC68A54 Advanced Data Link Controller (ADLC) interfaces to the RS-422 transmitter and receiver and the remainder of the transporter. The Corvus Monochip is a custom gate array which provides timing and control for all data transfers and decodes 6801 activity. Two other socketed chips included in the basic chip set are the transmitter and receiver. A low-power 75174 provides the transmitter functions and a low-power 75175 provides the receive functions in RS-422 format. For further information on the OMNINET chip set refer to the Networks Service Manual.

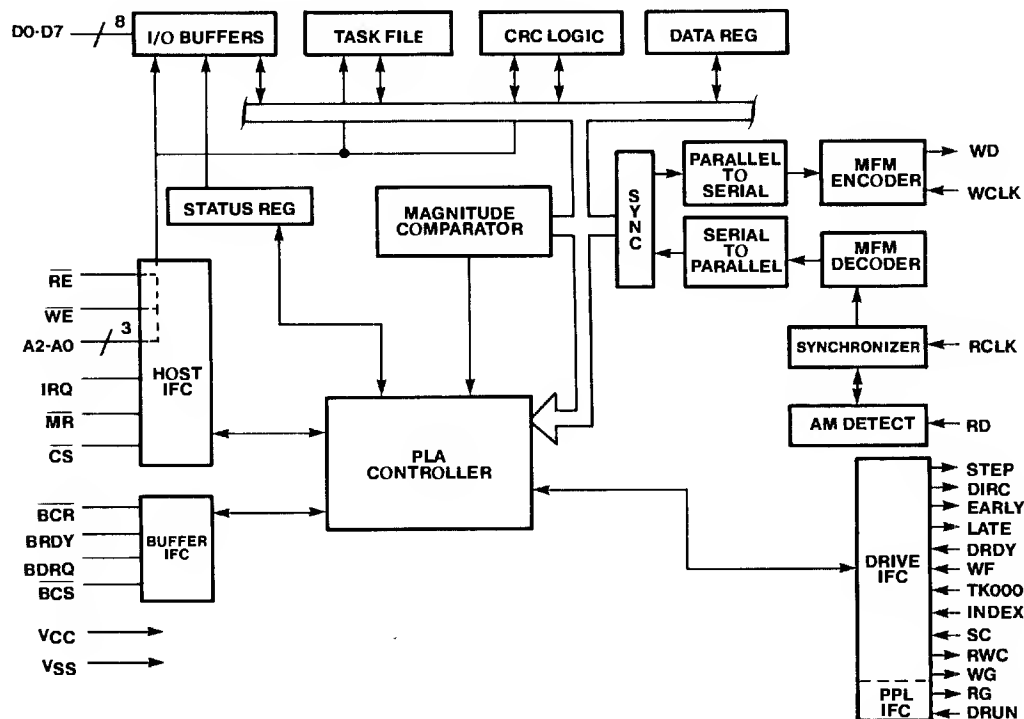
### **2.3.2 Disk Server**

The Disk Server provides the interface to and from the OMNINET transporter and the tape controller. The server section utilizes the same chip set as the transporter; it adds additional circuitry and memory buffers to translate Constellation protocol to disk drive commands.

### 2.3.3 Tape Controller

The Corvus interface for the Bank uses a WD1010, 40-pin, MOS/LSI chip as the main controller of the Bank. The WD1010 is manufactured by Western Digital Corporation. It is designed to control Winchester disk drives, but has been implemented as the Bank controller. The WD1010 is ideally suited as the Bank controller because it can be directed by the 6801 microprocessor in order to perform unique Bank commands.

The 6801 microprocessor directly issues commands to the WD1010. The commands are: Restore, Seek, Read, Write, Scan ID, Format. Before issuing these commands the WD1010 must be informed of parameters for these commands. This is accomplished via task files. Task files are simply registers within the WD1010 that can be directly accessed by the 6801. Task files specify on which track, sector, etc., to perform the specified command. For instance, a task file can be set up for track 4; executed by a format command, only track 4 would be formatted.



**Figure 2-3. WD1010 Architecture**

(Western Digital Corporation, *Storage Management Products Handbook*, 1984, page 211.)

The WD1010 uses an internal microcontroller called a programmable logic array (PLA). It controls the flow of data throughout the chip, formats the data, and recognizes and processes commands.

A magnitude comparator is also internal to the WD1010. This 10-bit comparator calculates drive step, direction, and present and target track position.

The Modified Frequency Modulated (MFM) data is encoded and decoded by the WD1010. The frequency of the encoder is equivalent to the write clock and the bit rate while the decoder frequency is generated by the read clock and the data separator.

The address mark detector (AM Detect) checks the incoming data stream for a unique missing clock pattern used in each ID and data field.

The Interface Circuit controls and monitors all lines to and from the tape with the exception of the read and write lines.



## 2.4 Read/Write CPU Board

All read and write functions to and from the Bank are controlled by the Read/Write CPU board. The intelligence of this board is derived from an Intel i8749 microprocessor. The Read/Write CPU board receives input signals from the OMNINET Bank Controller board and the tape drive mechanism. It outputs signals to the Tape Mechanism as well as the servo board.

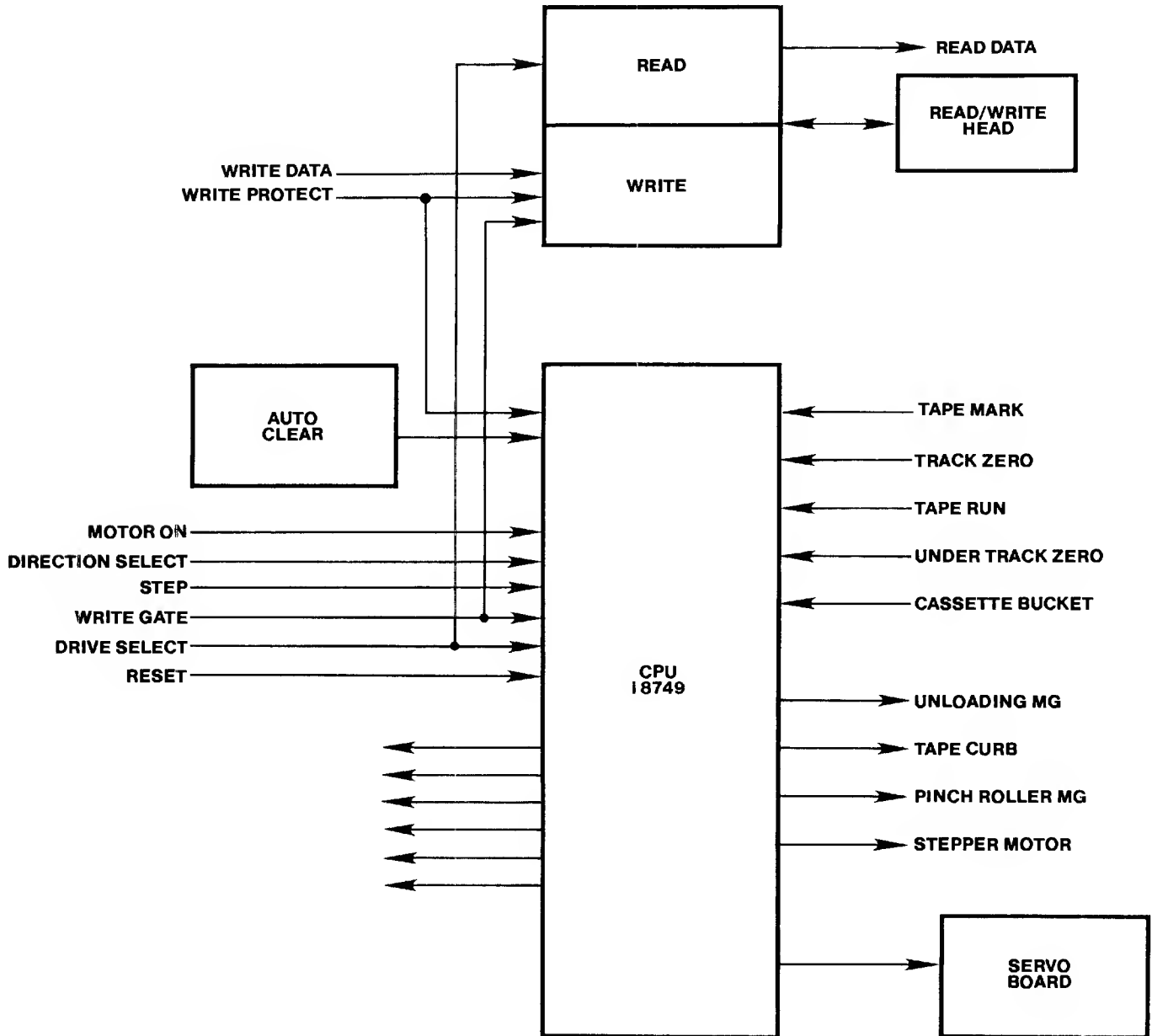


Figure 2-4. R/W Board Block Diagram

### 2.4.1 i8749 Microprocessor

The Intel i8749 microprocessor performs the major control tasks on the Read/Write board. It has a 2K X 8 bits program memory, a 64K X 8 RAM data memory, 27 I/O lines, an 8-bit timer/counter and built-in oscillator and clock circuits. The i8749 controls three major mechanical operations; they are the tape run control, tracking control and input signal detection.

The tape run control function is responsible for:

- **Motor ON-OFF Control**—Controls the switching of the servo motor to the ON and OFF states.
- **Pinch Roller Solenoid Control**—Controlling the solenoid which holds the tape between the capstan and the pinch roller when the tape is running.
- **Unload Solenoid Control**—Activating the solenoid and releasing the load arm when the servo motor stop signal is generated. This reduces shock to the tape during the transition from high speed operation to a complete stop.
- **Tape Hold Solenoid Control**—Maintaining the solenoid acts to insure tape positioning.
- **Tape Run and Servo Lock Detection**—Signals the CPU via a photo transistor that the tape is running and provides the tape speed.

The tracking control function is responsible for:

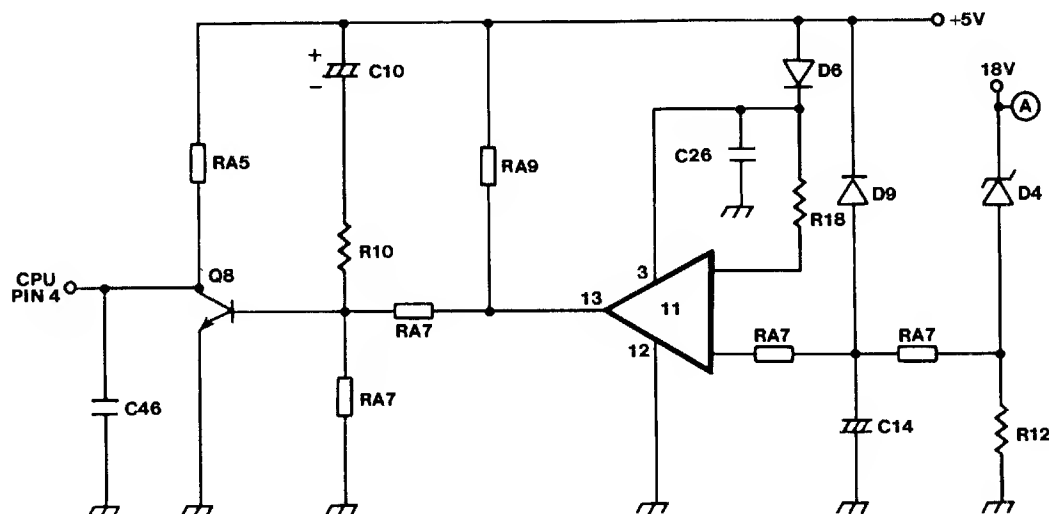
- **Stepper Motor Drive**—Controlling the stepper motor which moves the read and write head from track to track.
- **Track Zero Detection**—Detecting when the head is over track 0.
- **Under Track Zero Detection**—Detecting whether the head is lowered below track 0 and, therefore, in an unusable position.

The input signal detection function is responsible for:

- **Motor On/Off**—Sensing whether the motor is presently in the OFF or ON state.
- **Step Signal Detection**—Detecting the head step signal when it is stepping from track to track.
- **Direction Select Signal Detection**—Detecting which head direction is selected.
- **Write Gate Signal Detection**—Sensing if a write is being performed to inhibit track movement.
- **Cartridge Detection**—Detecting whether a tape cartridge is properly inserted in the cartridge holder.

### 2.4.2 Auto Clear Circuit

A key circuit on the Read/Write CPU board is the Auto Clear (or reset) circuit. Its purpose is, upon power up of the Bank, to reset the i8749 and the stepper motor drive circuit as soon as voltages are stable.



**Figure 2-5. Auto Clear Circuit**

As the power is applied to the circuit, the differentiating circuit (C10 & R10) changes the base to 'high' and turns on transistor Q8. The current then flows from the collector to the emitter and the collector voltage changes to 'low' sending a 'low' signal to pin 4 of the CPU, causing the CPU to be reset.

A short time after the power is switched on, the impedance of C10 rises and current will no longer flow to the differentiating circuit. When the voltage at 'A' exceeds 5.1 VDC, current will then flow to the zener diode D4 and the input condition of the comparator IC 11 will be  $V^- > V^+$ . The base voltage at Q8 changes to 'low' and Q8 turns off, releasing the reset condition of the CPU.

Since the voltage charge in C26 at the moment that the power is switched off is 4.3 VDC and the voltage charge at C4 is approximately 5.7 VDC, the condition of the comparator (IC11) is  $V^- > V^+$ . This causes the potential at pin 4 of the CPU to be maintained at a 'high' level.

When the discharge of C14 is complete, the input condition of the comparator changes to  $V^+ > V^-$  because C26 is continuing to discharge, therefore the potential of pin 4 of the CPU changes to a 'low', allowing the reset state to continue. The RA7 and C14 combination form a circuit to delay the reset signal.

#### 2.4.3 Stepper Motor Drive Circuit

The stepper motor drive circuit drives the head tracking motor. When the WD1010 sends a step pulse to the i8749, the i8749 will activate the stepper motor by providing a sequence of 8 pulses to the four coils in the stepper motor. These series of pulses will cause the motor to turn and move the head one track. The order in which the coils are activated by the i8749 determines the direction of head movement.

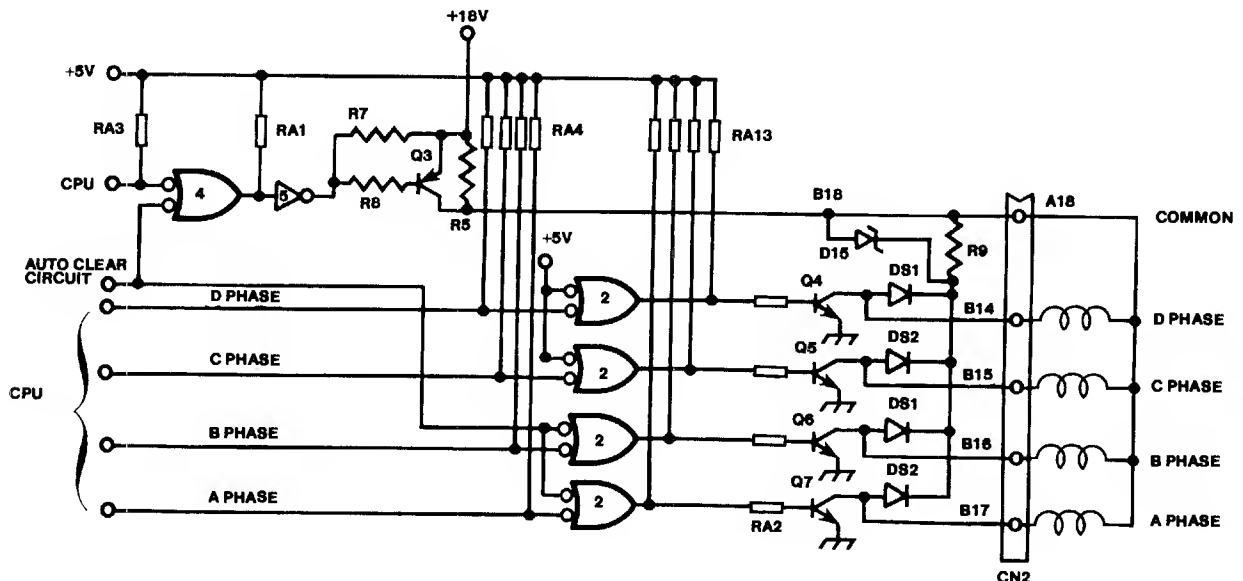


Figure 2-6. Stepper Motor Circuit

IC2 is a set of quad NOR gates which control transistors Q4, Q5, Q6, and Q7. Any 'Low' inputs from the CPU at pins 21 to 24 will produce a high output which turns on transistors Q4, Q5, Q6, Q7 to operate coils A, B, C, and D of the stepper motor.

An overdrive circuit is provided which is made up primarily of a NOR gate (IC4), an inverter (IC5), a transistor (Q3), and resistor R5. As the stepper motor operates, the CPU inputs a 'low' via pin 36 to the input of IC4 at pin 4 and the Auto Clear circuit provides a 'high' signal to IC4 at input pin 5. The output of IC4 then goes 'high' which then turns on transistor Q3, allowing +18 VDC to be delivered to each common pin of coils A, B, C, and D of the stepper motor.

When the motor is stopped, the signal on pin 36 of the CPU goes 'high' to turn transistor Q3 off. At this time a voltage of 18 VDC is supplied to the stepper motor through resistor R5. Consequently, a low voltage is supplied to the stepper motor to hold it in the stop position without generating an excessive amount of heat.

Condition	Active Coils
Stopped	A & B
Ascending (Toward Track 101)	A & B, B & C, C & D, and D & A
Descending (Toward Track 0)	A & B, D & A, C & D, and C & D

### Table 2-1. Coil Activating Sequence

2.4.4 **Index Detection Circuit.** Because continuous loop tape is used in the Bank, a marker is required to indicate the beginning location of the tape. This is accomplished with a combination of a phototransistor, LED, and a small piece of reflecting splicing tape on the backside of the tape. This index mark is detected by the phototransistor which is mounted next to the capstan pinch roller.

The schematic diagram illustrates the tape mark sensor circuit. It features a 5X power supply connected to a network of resistors (R15, R29, RA8, RA9, R11, R14) and a capacitor (C8). A 555 timer (11) is configured with its non-inverting input (+) connected to a voltage divider (RA9, R11) and its inverting input (-) connected to a diode (D5) and a capacitor (C15). The output of the timer is connected to a servo lock output and a tape mark sensor. The sensor is represented by a dashed box containing a diode and a transistor. The TAPE MARK input is connected to a 19-pin connector, which is also connected to a servo lock output.

When the splicing tape is not aligned with the tape mark sensor, the comparator output is in a 'high' state and the external output of IC19, pin 6 is at a 'high' state when the servo motor is operating at a constant speed. When the splicing tape is aligned with the tape sensor, the comparator output changes to a 'low' state, creating a 'low' state at the output of IC19 pin 6.

#### 2.4.5 Track Zero Detection Circuit

Track 0 detection circuit informs the i8749 if the head is located at track 0.

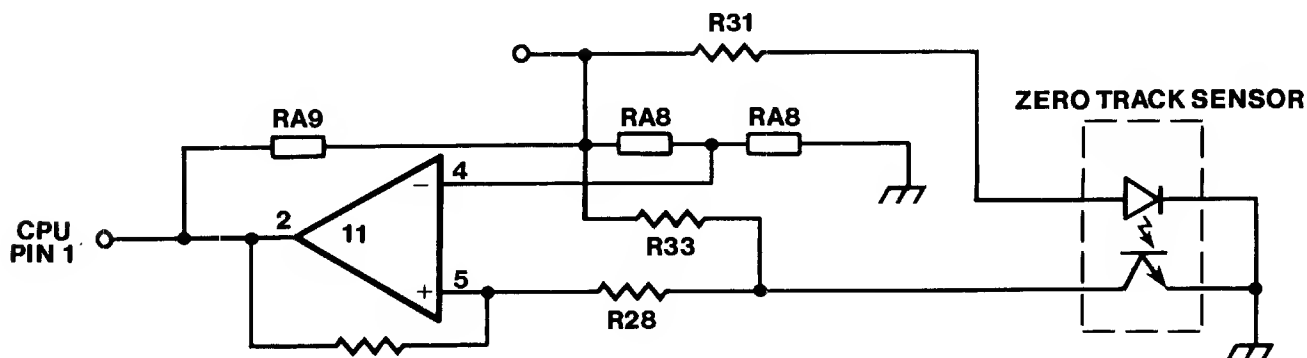


Figure 2-8 Track Zero Detection Circuit

The track 0 detection circuit is very simple. An LED and a phototransistor are placed in alignment above and below the two track 0 sense gears. Each gear has a single small hole near its outer edge. When the gear holes align allowing the L.E.D to excite the phototransistor, it signals the comparator that the head is at track 0. The comparator (IC11) then outputs a 'low' signal to the CPU at pin 1. When there is no light detected by the phototransistor, the comparator outputs a 'high' to the CPU.

#### 2.4.6 Cartridge and Holder Detection Circuit

The cartridge detection circuit uses a leaf switch as a detector to notify the CPU that there is a cartridge properly positioned in the cartridge holder. In series with the cartridge detection switch is the cartridge holder detection switch. A normally closed switch, it momentarily opens when an operator opens or closes the cartridge holder.

The two leaf switches are arranged in series and perform functionally as an AND gate. Both switches must be set, i.e. a cartridge must be inserted and the holder must be set in order for the proper signal to be sent to the CPU.

Also in series with these two switches is the Bank RESET switch. The RESET switch is located at the rear of the Bank cabinet between the power receptacle and the on/off switch. A momentary open switch, it performs the same function as the cartridge holder detection switch. If for some reason the tape servo motor will not stop spinning, pressing this switch will stop the motor.

#### 2.4.7 Write Protect Detection Circuit

The Bank tape uses a write protect tab on the bottom of the cartridge to enable write protection. If the tab is broken off, the write protect circuit detects it by means of a leaf switch and disables the write operation by a sending signal to the CPU.

#### 2.4.8 Under Track Zero Detection Circuit

This switch is located under the read/write head. In the event that the head should travel below track 0, the under track zero detection switch sends a signal to the i8749 processor. The result of this condition will appear to the WD1010 as a tracking error (see table 2-2).

### 2.4.9 Error Circuit

The error circuit enables the CPU to send an error signal to the WD1010 when a tape run error or tracking error has occurred. The signals to the controller in the form of 'high' and 'low' signals are output from the CPU at pin 33 and 34.

Status	i8749 Pin 33	i8749 Pin 34
Normal	High	High
Tape Run Error	High	Low
Tracking Error	Low	Low
IC9 Reset	Low	Low

Table 2-2. CPU Error Signal Status

### 2.5 Servo Assembly

The Bank servo board is responsible for controlling the tape servo motor. The only electrical adjustment which can be made to the Bank is the servo motor speed adjustment on this board. It is located behind the tape drive mechanism and in front of the power supply. The block diagram below illustrates the general operation of the servo board.

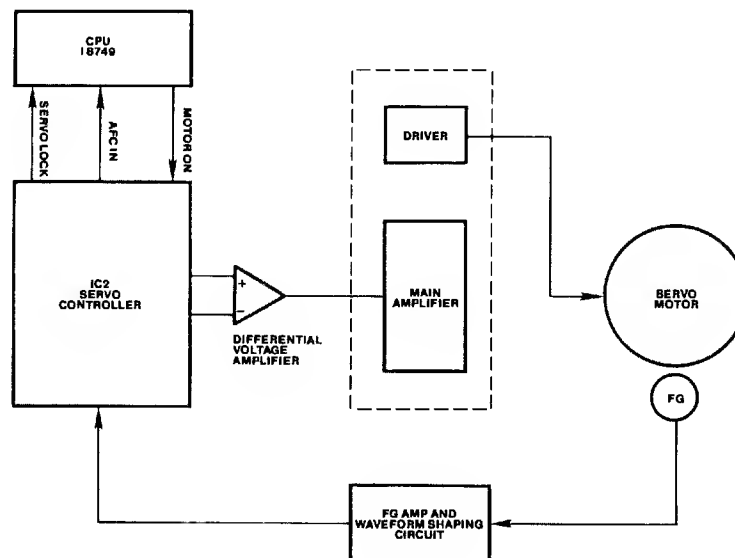


Figure 2-9. Servo Board Block Diagram

The servo board can be divided into five major sections:

- Servo Controller Chip
- Constant Voltage Circuit
- Differential Amplifier Circuit
- Motor Driver Circuit
- FG-AMP and Waveform Shaping Circuit

### 2.5.1 Servo Controller Chip

Most of the servo control function is provided by IC2 (TC9142P) on the servo board.

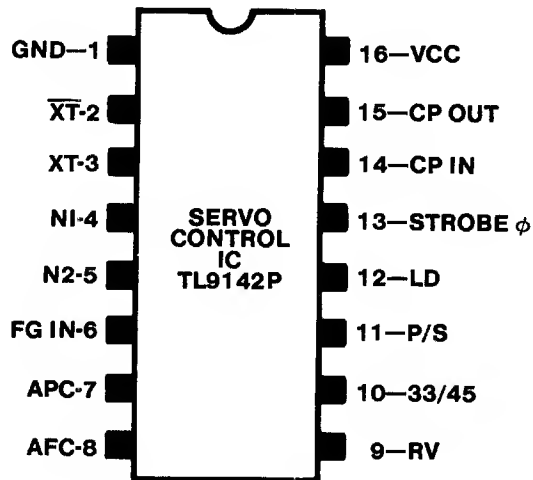


Figure 2-10. Servo Control IC

The servo controller is an 8-bit digital to analog converter which is used for speed control (AFC) and phase control (APC).

### 2.5.2 Constant Voltage Circuit

This circuit provides a constant 7.5 VDC to the Servo Controller IC2.

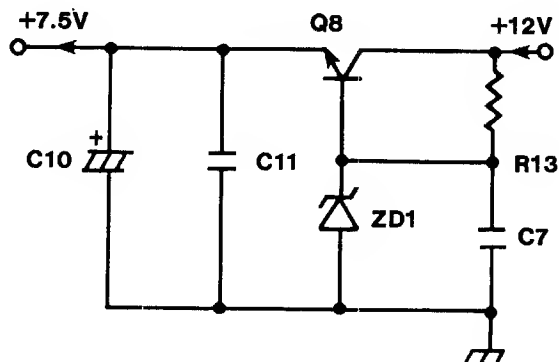
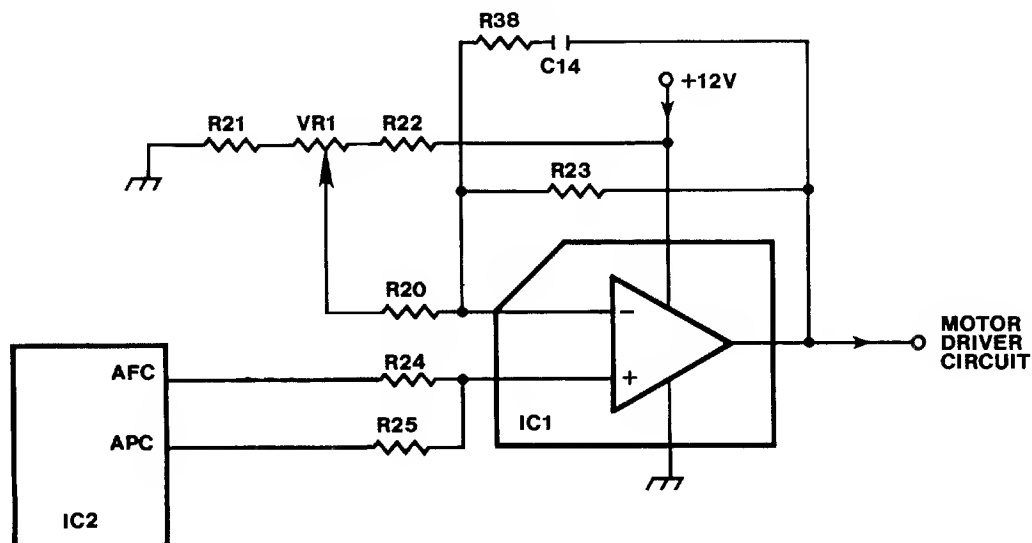


Figure 2-11. Constant Voltage Circuit

When 12 VDC is applied to the circuit, current flows through R13 to ZD1. The anode of ZD1 and the base of Q8 are maintained at 8.2 VDC. Then, current flows from the base to the emitter and Q8 provides the necessary current to the load circuit. The emitter potential of Q8 drops below the base potential by approximately 0.7 VDC to 7.5 VDC. Thus Q8 supplies a constant voltage to the load circuit at the same time it supplies the necessary current.

### 2.5.3 Differential Voltage Amplifier Circuit

The differential voltage amplifier circuit amplifies the weak signals of APC and AFC from IC2 and feeds them to the motor drive circuit. It does so by using an operational amplifier, IC1, to maintain the servo motor speed at 3600 RPM.

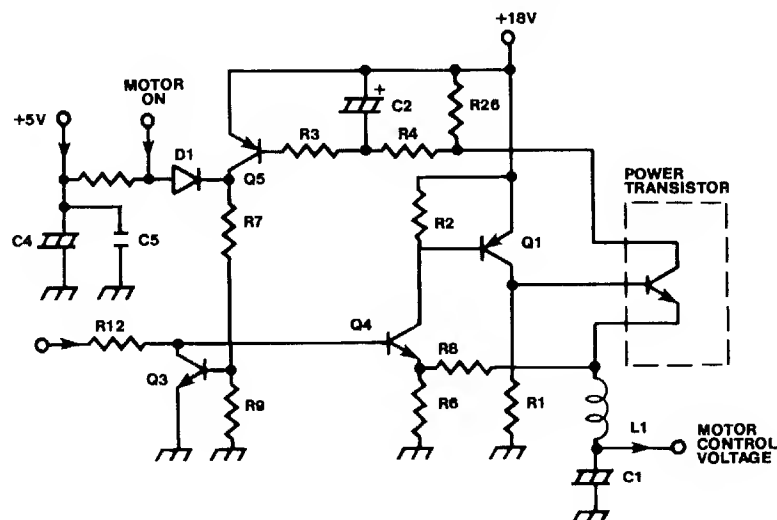


**Figure 2-12. Differential Voltage Amplifier Circuit**

The voltage output of APC and the AFC indicate the voltage deviation from the motor reference speed. The operational amplifier amplifies this voltage to maintain the motor at the reference speed. VR1 is a control to maintain the servomotor at 3600 RPM.

### 2.5.4 Motor Driver Circuit

The motor driver circuit provides the voltage necessary to turn the servo motor at a constant speed. This voltage is provided by a combination of the output of the differential amplifier and the MOTOR ON signal from the CPU.

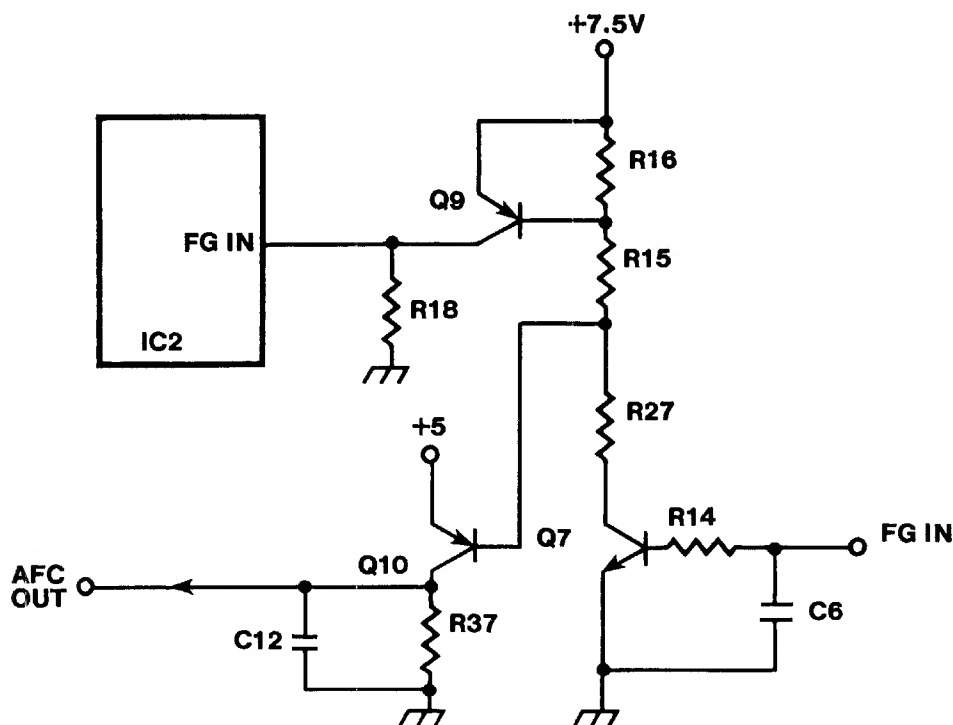


**Figure 2-13. Motor Driver Circuit**



Transistor Q5 is used to prevent overcurrent to the servo motor. If an overcurrent flows through the motor, a voltage of 0.7 VDC is generated at resistor R26 to turn on Q5 and Q3, allowing no current to flow to the servo motor. R3, R4 and C2 form a circuit which prevents a momentary overcurrent from flowing through the base of Q5.

The FG-Amp and waveform shaping circuit amplifies and shapes the FG-IN signal from the PG coil and inputs it into IC2.



When the signal from the PG coil is input to the base of transistor Q7, Q7 turns on only when the base input voltage exceeds approximately 0.7 VDC which is the voltage drop between the base and the emitter. At the same time Q9 and Q10 turn on allowing the FG-IN signal of 7.5 VDC to be input to IC2.

The Bank power supply provides +5 VDC, +12 VDC, and +18 VDC. All voltages have a  $\pm 0.1$  volt tolerance. Both the 100-120 VAC and 220-240 VAC models use a 250 Volt, 2 Amp fuse.

**CHAPTER 3**  
**DISASSEMBLY/ASSEMBLY**



## CHAPTER 3

### DISASSEMBLY/ASSEMBLY

#### 3.0 Scope of Chapter

This chapter describes the disassembly and assembly procedures for the Bank. Instructions for replacement of modules is included.

#### 3.1 Introduction

Disassembly of the Bank is simple due to its modular design. The basic subassemblies are:

- OMNINET Bank Controller Board
- Read/Write CPU Board
- Servo Board
- Power Supply
- Power Connector and Switch
- Tape Cartridge Holder
- Tape Drive Mechanism

The following are needed for disassembling the Bank:

- Phillips screwdriver (a #2 screwdriver can be used for most disassembly procedures. A #1 may be necessary for some screws.)
- Small flat blade screw driver

#### 3.2 Disassembly

##### **WARNING:**

***Before beginning, turn off the AC power and remove the cord. Disconnect the tap cable from the network.***

##### 3.2.1 Cartridge Holder

The cartridge holder must be removed before cleaning the head or removing the top encasement cover.

1. Remove the tape from the holder if a tape is in place. With the AC power off and the power cord disconnected, remove the OMNINET tap cable from the rear of the cabinet.

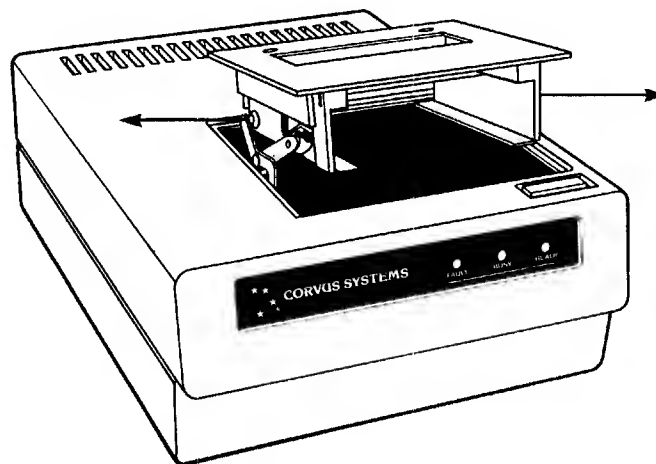


Figure 3-1. Tape Cartridge Holder

2. Remove the cartridge holder by gently spreading the rear-most support arms until the pins are free. Lifting the rear of the holder, slide the entire holder toward the back of the cabinet. Remove the holder from the front support arms when the front pins reach the wide end of the slots.

**CAUTION:**

**Do not attempt to remove the foam top from the cartridge holder.**

**3.2.2 Top Encasement**

Before removing the top encasement, the cartridge holder must be removed; refer to section 3.2.1 for instructions.

1. Locate the two phillips screws beneath the ridge of the front bezel and remove them. Locate the two phillips screws at the rear bezel and remove them.
2. Carefully lift the top encasement until the cable from the front indicator LED PCA is accessible at the Read/Write board. Disconnect at the Read/Write CPU board and lift the top assembly out and away.

**3.2.3 LED Board**

Remove the top encasement (section 3.2.2) before removing the LED PCA. The LED board should be removed only to service the board or when an exchange of a damaged top encasement is made.

1. Locate the LED board in the top half of the encasement and unlock the cable retainer securing the wiring to the encasement.
2. Using a flat-bladed screw driver, gently pry the LED board away from the front bezel, taking care not to stress the LED leads.

**3.2.4 OMNINET Bank Controller Assembly**

Remove the top encasement (section 3.2.1).

1. Locate the Omninet Controller board as shown in illustration 1-2. Remove the 34-pin flat ribbon cable J3, from the connector on the Omninet Controller board.
2. Remove the power connector J2 at the base of the controller board and lift the board up and out of the slot.

### 3.2.5 Read/Write CPU Assembly

The OMNINET Bank Controller board should be removed (3.2.4) prior to removing the Read/Write CPU board.

1. Locate the Read/Write CPU board shown in Figure 3-3. Remove the cable going to the Read/Write head; note the correct connector orientation.

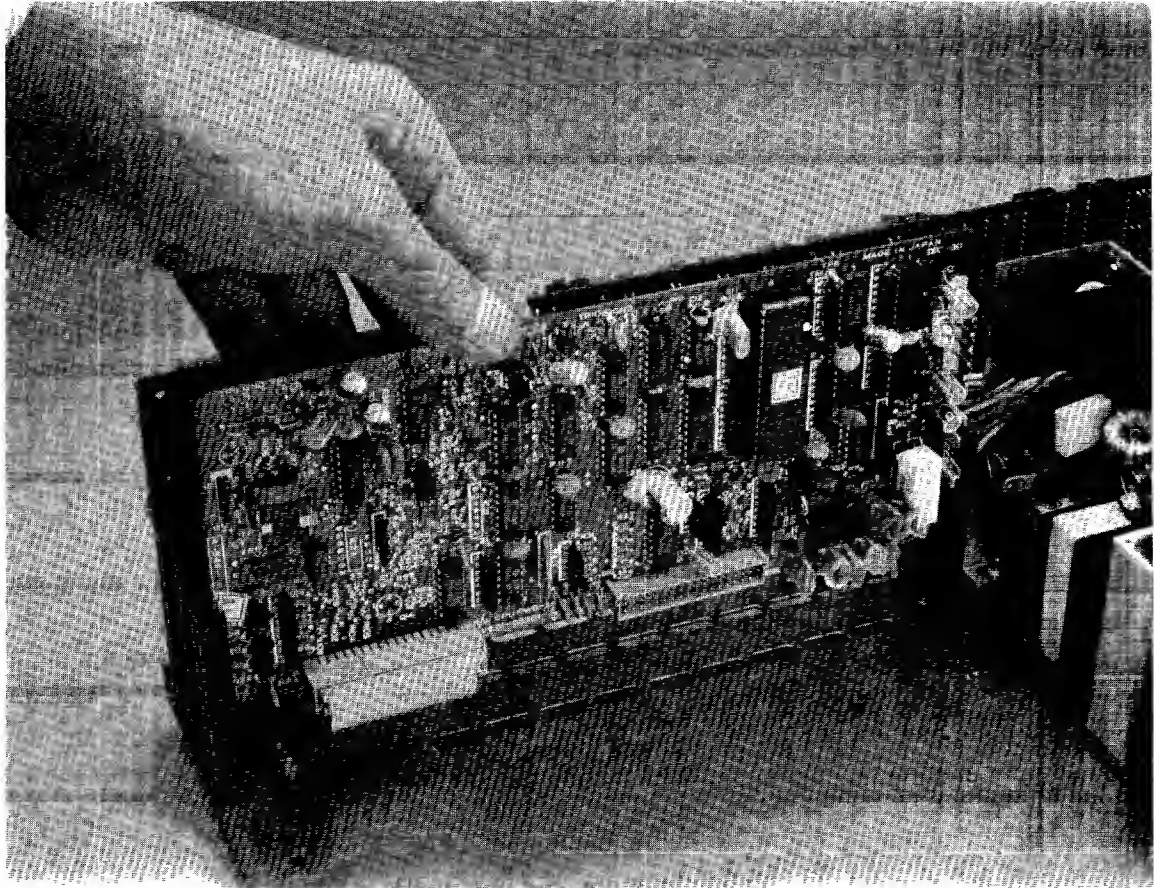


Figure 3-2. Read/Write CPU Board

2. Remove the power cable from the power supply. You may have to lift the Read/Write CPU board partially out of the slot to access the connector.
3. Remove the cable leading to the Bank servo board.
4. Lift the Read/Write CPU board completely out of the slot, disconnecting the wiring harness leading to the underside of the tape drive mechanism.
5. Remove the 34 pin flat ribbon cable from the Read/Write CPU board.

**3.2.6 Servo Board**

Removing the tape drive mechanism before removing the servo board, although not necessary, will allow easier access. Refer to section 3.2.10 of this chapter to remove tape mechanism.

1. Disconnect the five wire connector (CN1) which leads from the servo board to the underside of the tape mechanism.
2. Disconnect the eight wire connector (CN3) leading to the Read/Write CPU card.

**NOTE:**

*If the servo board is being removed without removing the tape drive mechanism, it will be easier to disconnect this after the mounting screws have been removed as in step 3.*

3. Remove the two mounting screws which hold the servo mounting bracket to the chassis and lift out the servo assembly.

To remove the servo board from its mounting bracket:

1. Unscrew the transistor mounted cable from the mounting bracket.
2. Squeeze the retaining flanges of the plastic stand-offs together and pull the board off the bracket.

**3.2.7 Bottom Encasement**

Before the Bank chassis can be removed from the bottom encasement the top encasement (section 3.2.2) must be removed.

1. Supporting the front end with one hand, slide the Bank forward until the front edge extends about 2 inches over the edge of the work table. Remove the two mounting screws from below with a Phillips screw driver.
2. Slide the Bank back, securely onto the work table. Turn the Bank 180 degrees, the back now facing the edge of the work table, and repeat step 1 to remove the two rear screws.
3. Replace the Bank securely onto the work table. The entire chassis may now be removed from the bottom encasement by lifting straight up.

**3.2.8 Power Supply**

The Bank chassis must be removed from the bottom encasement to access the power supply mounting screws. See section 3.2.7 for instructions.

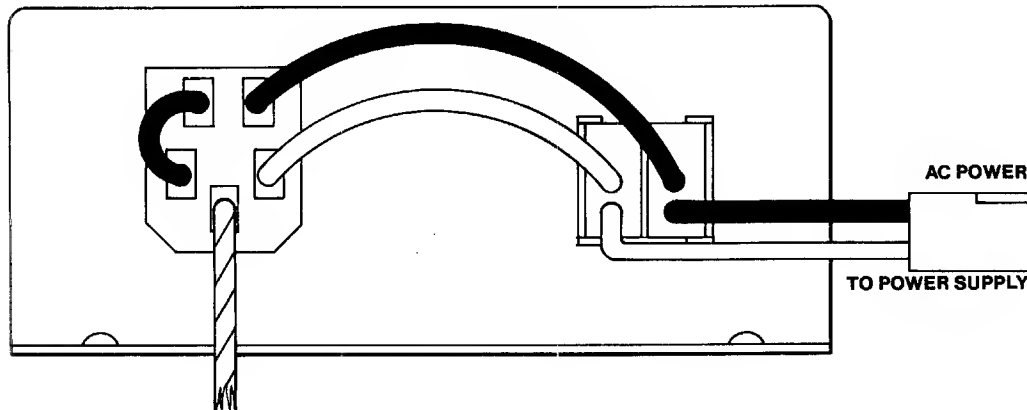
The procedure for removing the power supply assembly from the chassis is similar to that for removing the chassis from the bottom encasement. The Bank chassis rests flat on the work table. The unit is slid forward until the power supply mounting screws can be accessed from below.

1. Unscrew the grounding wire from the chassis.
2. Remove the tie wrap which holds the cable to the OMNINET Bank Controller board to the chassis.
3. Disconnect the AC power line from the AC switch assembly.
4. Place the Bank chassis so the power supply is near the edge of the work table. Supporting the chassis with one hand, slide the chassis forward over the edge about 2 inches. From below, remove the screws mounting the power supply bracket to the chassis.
5. Slide the chassis completely onto the work table. Lift out the power supply assembly.

**3.2.9 AC Power Assembly**

The AC power assembly can be removed after the top encasement has been disassembled; no other modules need to be disassembled.

1. Disconnect the AC power line leading to the power supply. (If the power supply has been removed, this disconnection will have already been made.)



**Figure 3-3. AC Power Assembly Connectors**

2. Unscrew the earth ground wire from the chassis.
3. If this was not done to remove the mechanism previously, disconnect the wires from the RESET switch to the tape drive mechanism; note the correct orientation for reassembly.
4. Remove the two mounting screws securing the AC power assembly to the chassis. Lift the assembly out.

#### **3.2.10 Tape Drive Mechanism**

It is not necessary to remove the cartridge support assembly to remove the tape drive mechanism.

1. Disconnect the wires from the mechanism to the RESET switch.

*NOTE:*

*When viewed from the rear, the wires exit the connector towards the left and that the connector attaches to the UPPER two pins on the switch assembly.*

2. Remove the Bank mechanism from the stand-offs by removing the four screws at the corners of the Bank tape mechanism.
3. Lift the mechanism slightly away from the servo and Read/Write CPU boards to allow clearance for removing the eight-wire connector from the Servo board, and the wire harness from the Read/Write CPU board.

#### **3.3 Reassembly**

To reassemble the Bank, reverse the procedures described in section 3.2.

##### **3.3.1 Head to Read/Write Board Connector**

To reconnect the head connector to the Read/Write CPU board, be sure that the ground wire of the five pin connector is at the top of the connector (pin #5).

##### **3.3.2 RESET Connector**

The connector from the tape drive mechanism to the RESET switch plugs onto the top two posts of the RESET switch. The wires exit the connector to the left when viewed from the rear.





**CHAPTER 4**  
**DIAGNOSTICS**



## CHAPTER 4 DIAGNOSTICS

### 4.0 Scope of Chapter

This chapter provides a general description of the use of the Bank diagnostic program, BDIAG; instructions for running the program are NOT included. For instructions and additional information on the Bank diagnostics see the Bank Diagnostic Guide.

### 4.1 Introduction

BDIAG is used to find and correct media defects which cause errors and degrade the performance of the BANK. The diagnostic also provides a means of checking:

- Firmware Version
- Bank Parameters
- Spare Blocks Table

### 4.2 Diagnostic Functions

This describes the diagnostic functions available in the BDIAG program. The Corvus diskette labelled "Bank Diagnostic Utilities" contains the BDIAG program.

When BDIAG is run the following menu appears:

- V — VERSION check
- P — Display BANK PARAMETERS
- C — Perform Verify-scan for bad tracks
- D — DISPLAY or alter spare block tables
- R — RECOVER format results
- F — Perform tape FORMAT
- S — SET diag data block file name
- L — Read version LEVEL of Diag Data Block
- I — Modify INTERLEAVE
- U — UPDATE firmware on BANK
- N — Write tape NAME
- W — WRITE Corvus volume
- E — Exit

#### 4.2.1 Version Check

The V option gives information about the Bank. This option is not destructive to data on the tape. Version Check gives the following information:

- Tape capacity in 512-byte blocks
- Sectors per Track
- Tracks per Bank
- Firmware Revision level
- Tape time (in hours)
- Start/Stop count

Tape time is the total number of hours the tape has been used. Corvus recommends a maximum tape life of 500 hours.

Start/Stop count is the number of times the tape has been stopped and restarted. The start/stop count on a reliable tape should not exceed 500.

#### 4.2.2 Display Parameters

The P option is the display PARAMETERS option. This option gives the parameters which include :

- Cartridge Name
- Cartridge Length (in meters)
- Interleave Specification

#### 4.2.3 The C Option

This gives a choice between Verify and Certify; You are prompted to type V or C to continue.

##### 4.2.3.1 Verify

Verify can be performed on the entire tape, or specific tracks of the tape. VERIFY takes approximately 35 minutes on a 100-MB tape, and 70 minutes on a 200-MB tape. To VERIFY a single track takes approximately 1 minute on a 100-MB tape, and 2 minutes on a 200-MB tape.

##### 4.2.3.2 Certify

#### CAUTION:

**CERTIFY is destructive to data. Backup the tape before certifying whenever possible.**

The CERTIFY function, like VERIFY, checks the CRC checksum of each Sector, but unlike VERIFY, it checks the media four times, and automatically spares bad blocks.

Since CERTIFY performs media checks four times, it ensures a more reliable check than VERIFY; however, this is at a considerable cost in time.

A 100-MB tape takes approximately five hours, and a 200-MB tape about 10 hours to CERTIFY.

To CERTIFY a track takes approximately 3½ minutes on a 100-MB tape, and 6½ minutes on a 200-MB tape.

It is recommended that VERIFY be run first to identify bad sectors, then each track containing those sectors may be certified individually.

#### 4.2.4 Display or Alter Spare Blocks Tables

The D option allows you to do the following:

- DISPLAY the contents of the spare block table.
- CONVERT a logical block number to a physical one.
- Show the RANGE of blocks a track contains.
- ADD a block to the spare block table.
- DELETE a block from the spare block table.

#### 4.2.5 Recover Format Results

The R option displays the contents of a file containing the results of a FORMAT of the tape. When FORMAT is run, bad blocks are spared automatically by the FORMAT program.

The results are listed in the BNKRSLTS.TEXT file (or an alternate file, if specified).

#### 4.2.6 Format

The F option allows the user to format new tapes or to reformat a tape suspected of having errors in the sector address or header portion(s) of a sector.

#### CAUTION:

**FORMAT is destructive to data.**

**4.2.7 Set Diag Data Block Filename**

The S option allows the user to set the name of the data file for the Bank diagnostic program. The BDIAG program defaults to BK.DIAG.DATA for this file name.

**4.2.8 Read Version Level of Diag Data Block**

The L option gives the version number of the data file the Bank Diagnostic program uses; you may be asked for this number by a Corvus service representative before performing the S option (see 4.2.7 above).

**4.2.9 Modify Interleave**

The I option allows the user to modify the interleave factor for the tape. BDIAG defaults to 11 as an optimum interleave factor. Before changing the interleave factor, back up the Bank tape.

Refer to chapter 3 of the Bank Guide, and the "Resetting the Interleave Factor" section of the Bank Diagnostic Guide for instructions and additional information on using this option.

**4.2.10 Update Firmware**

The U option allows the user to UPDATE the Bank firmware to a new revision level, or rewrite the existing firmware on the tape in case the firmware was damaged.

The firmware is the Bank operating system software; it resides on track 1 of the tape. If the firmware becomes damaged, it will cause the Bank controller to give error messages to the host Computer, or fail to function at all.

When this happens, the user must attempt to write a new copy of the firmware to the tape, using the U option.

**4.2.11 Write Tape Name**

The N option allows the user to assign a unique NAME to each tape, so that the contents may be easily identified.

**4.2.12 Write Corvus Volume**

The W option allows the user to write the Corvus volume on the tape; the Corvus volume contains information that the Constellation II software requires.

This option is not normally used; however a Corvus Service Representative may ask you to WRITE the Corvus volume if it is suspected of being damaged.

This option is included as an option when FORMAT is run; when selected with FORMAT, the Corvus volume is written automatically when formatting is complete.

**4.3 Inactivating Bad Tracks**

Up to four sectors can be spared on each track. If more than four sectors contain bad blocks (each sector contains two blocks), the entire track must be inactivated.

Inactivating a track creates a new, empty volume to place over the bad track; the volume is not granted write access and prevents the track from being used to store Data.



**CHAPTER 5**  
**MAINTENANCE**





## CHAPTER 5 MAINTENANCE

### 5.0 Scope of Chapter

This chapter describes maintenance procedures for the Bank. Preventive maintenance, including cleaning and lubrication, and mechanical and electrical adjustments are discussed.

### 5.1 Introduction

Proper operation, longer operating life, and increased reliability will be realized if maintenance procedures are followed as described in this chapter.

Preventive maintenance should be performed every 1000 operating hours or every 12 months, whichever comes first.

The only electrical adjustment that may be performed on the Bank is the servo motor speed adjustment which must be performed whenever the servo board is replaced.

Tools and equipment required for service are:

#### Materials

- Diamond Oil #440
- Contact grease
- Application brush
- Cotton swabs
- Metal head cleaning solution

#### Tools

- #1 and #2 Phillips screw drivers
- Small flat-blade screw driver
- Dual trace oscilloscope
- 2 scope probes
- 0.02 inches or 0.5 mm feeler gauge

### 5.2 Preparing for Maintenance

The following steps must be performed before any maintenance or adjustments may be made.

1. Ensure the tape has stopped moving (press the RESET switch on the rear of the Bank if necessary).
2. Press the eject button and remove the cartridge.
3. Turn off the Bank and remove the power cord.
4. Disconnect the tap cable.
5. Remove the Cartridge Holder (section 3.1)
6. Remove the Top Encasement (section 3.2)

### 5.3 Cleaning Procedures

Complete cleaning should be performed as preventive maintenance.

#### 5.3.1 The Read/Write Head

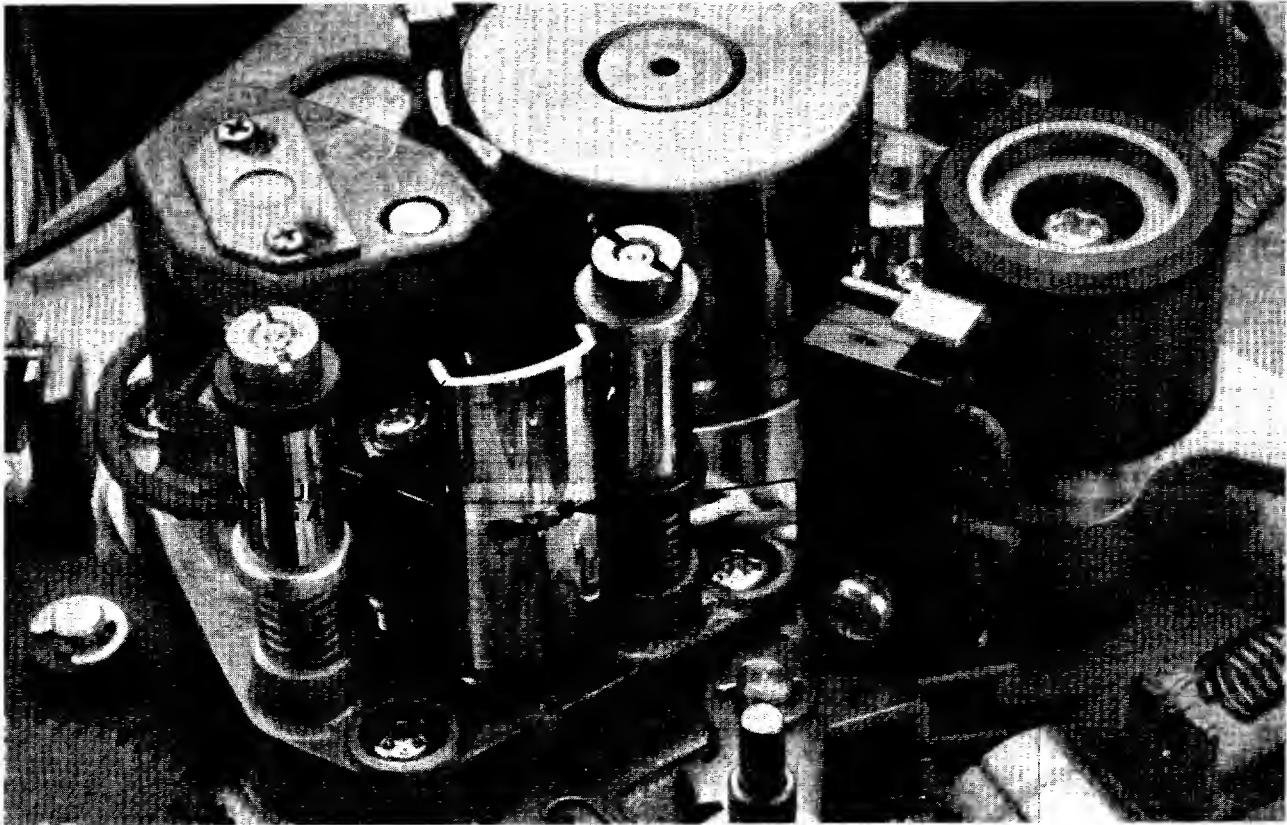
Periodic cleaning of the read/write head is recommended and should be performed as preventive maintenance or when read/write errors are encountered. The head is very delicate and the cleaning procedure should be carefully followed. Use a commercial head cleaning solution and cotton swabs. To clean the read/write head:

1. Apply the head cleaning solution to a cotton swab.
2. Use the cotton swab to apply the cleaning solution to the entire surface of the read/write head.

#### CAUTION:

**The polished, precision surface of the head must not be scratched or marred in any way. Pressing too hard with the cotton swab or using something other than a cotton swab may cause damage to the head.**

3. Using a dry cotton swab, wipe the head dry.
4. If either swab shows any contamination then repeat steps 1-3.
5. Inspect the surface of the head, checking for any loose cotton fibers; remove them with another swab, if necessary.



**Figure 5-1. Read/Write Head Cleaning**

### **5.3.2 Tape Path Cleaning**

Several parts of the tape drive mechanism guide the tape as it moves through the capstan and read/write head areas. These parts should be cleaned during preventive maintenance or any time tape jamming occurs. Cleaning should be performed with cotton swabs and a commercial head cleaning solution. Refer to figure 5-2 and 5-3 for locations to be cleaned. **CLEAN ONLY THE POINTS SHOWN.**

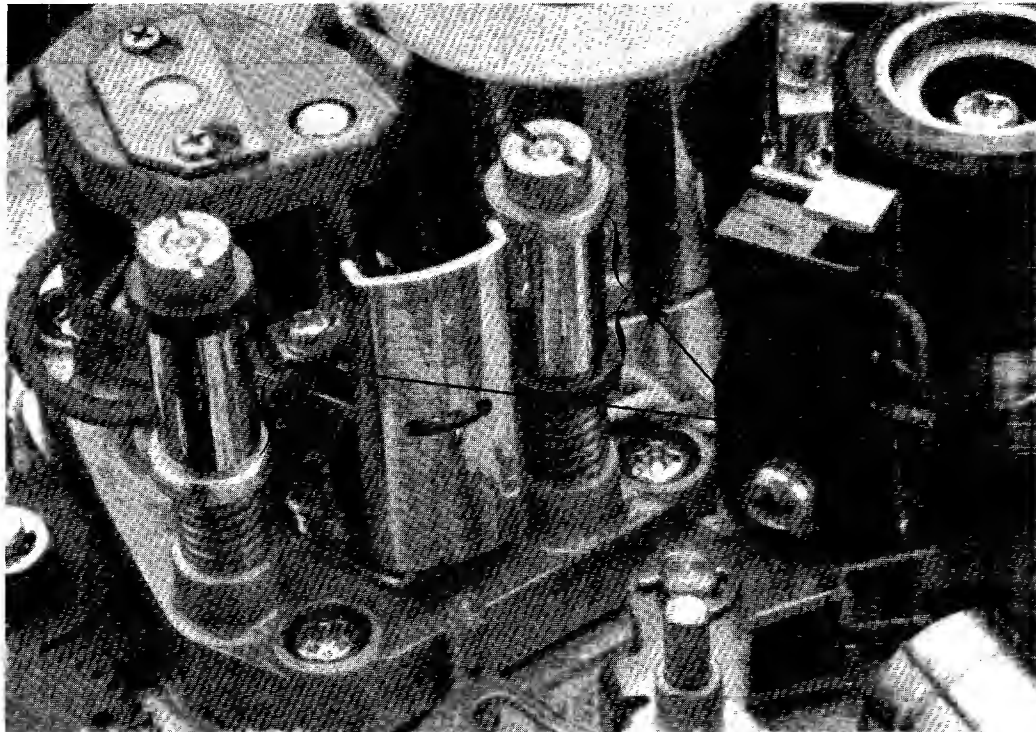


Figure 5-2. Tracking Area Guides

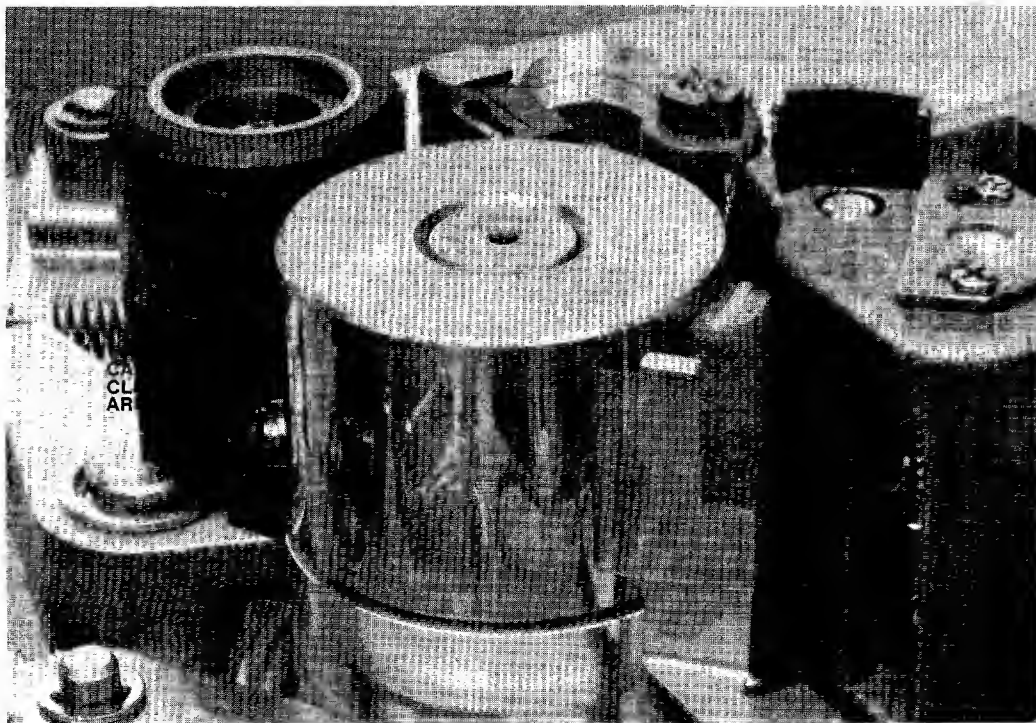


Figure 5-3. Capstan

To clean the tape tracking area use cotton swabs and a commercial head cleaning solution. Do not touch the surface of these parts with your fingers.

**CAUTION:**

**Clean only the parts as stated. Do not apply cleaning solution to any rubber or plastic parts in the Bank.**

1. Clean the left and right guide collars and wipe dry with a clean, dry cotton swab.
2. Clean both under roller guides as shown in figure 5-2. While cleaning the rollers, turn them through their entire rotation to insure that the entire surface of each roller is cleaned. Wipe dry with a clean cotton swab.
3. Clean the entire surface of the capstan as shown in figure 5-3.

**CAUTION:**

**Do not turn the capstan.**

Wipe dry with a clean swab.

4. Inspect the head and tape tracking areas for any foreign particles, such as cotton fibers, and remove them.

If you are performing preventive maintenance proceed to lubrication in the next section. If not, reassemble the Bank as described in section 3.3.

#### **5.4 Lubrication**

The Bank requires periodic lubrication on the cartridge support assembly and the head tracking worm gear. Apply specified oil or grease only to the points indicated.

**CAUTION:**

**Do not use excessive amounts of lubrication, usually one drop will be sufficient. Do not allow any oil or grease to get on any other parts, especially the read/write head or capstan.**

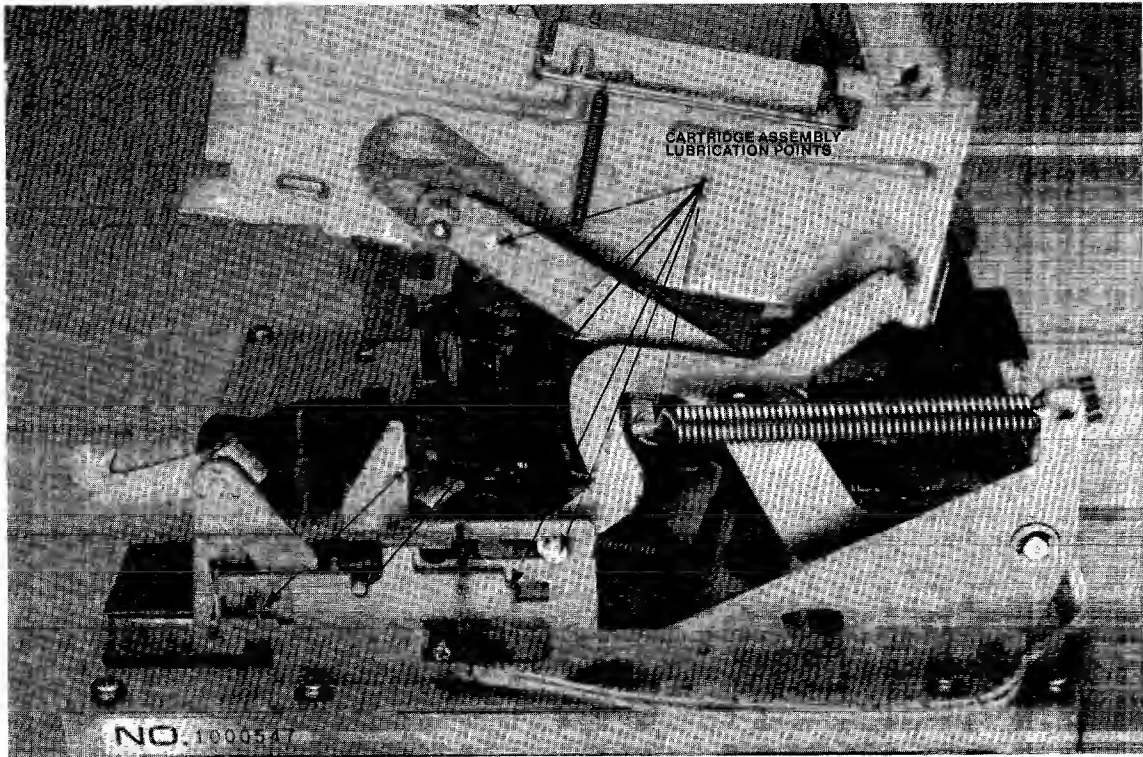
##### **5.4.1 Cartridge Holder Support Assembly**

The cartridge holder support assembly is the precision positioning mechanism which lowers the tape cartridge into position, and ejects the cartridge when the eject button is depressed. Lubrication of this assembly insures smooth operation and longer life to the parts.

**CAUTION:**

**Lubrication of the support assembly should only be performed as preventive maintenance. Excessive oil or grease may cause contamination of the tape tracking area.**

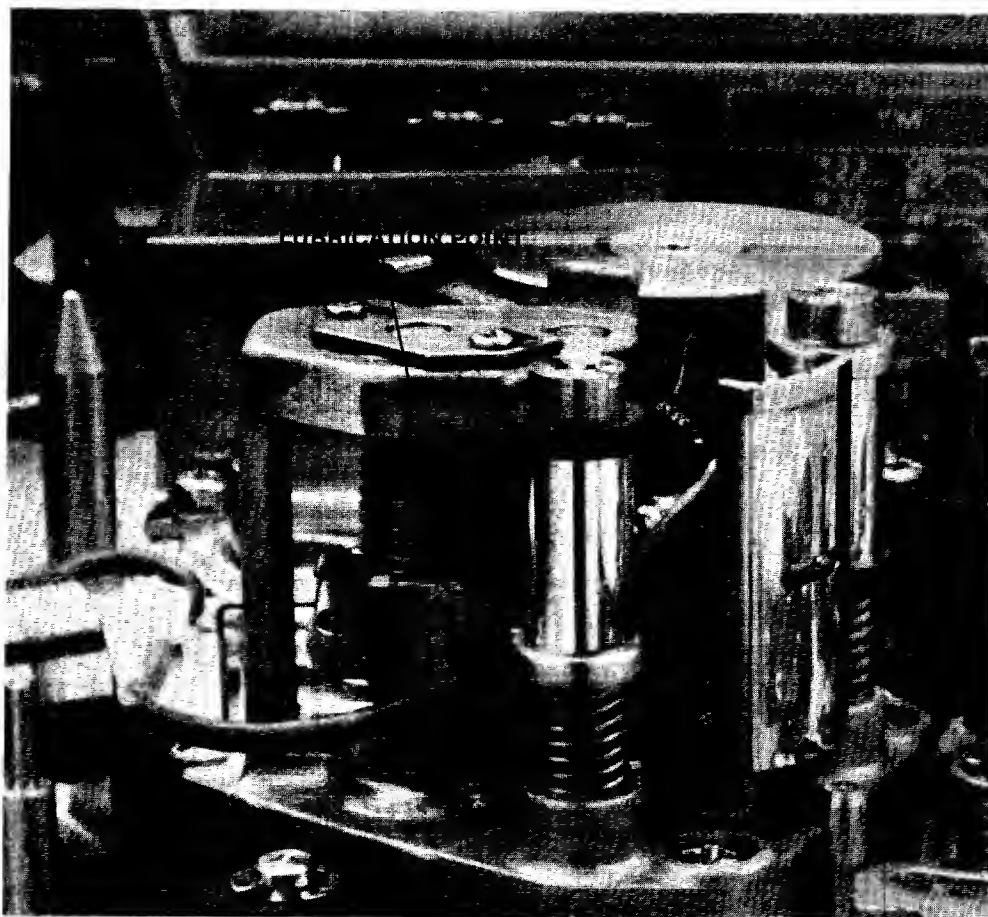
1. Reassemble the cartridge holder on the support assembly (see section 3.3).
2. Check the operation of the cartridge holder by inserting a tape. The cartridge should slide smoothly into the holder with minimum force. If the cartridge cannot be inserted easily, remove it from the holder and check the entire assembly for shape uniformity. If either the cartridge holder or support assembly appears damaged or distorted, the entire tape drive mechanism must be replaced. Procedures for the mechanism replacement can be found in section 3.3.
3. Using a brush, apply a small amount of grease to the points indicated in figure 5-5. Note that lifter shaft requires a drop of diamond oil #440 rather than grease. Also apply diamond oil to the lifter's idler gear shaft (located only on the lower right side of the cartridge support assembly).



**Figure 5-4. Cartridge Support Assembly Lubrication**

#### 5.4.2 Worm Tracking Gear

The worm tracking gear should be oiled during preventive maintenance only. Too much oil could cause the excessive oil to contaminate the tape tracking area. Apply two drops of oil to the felt pad.



**Figure 5-5. Worm Tracking Gear Lubrication**



### 5.5 Mechanical Adjustments

There are three leaf switches on the tape drive mechanism which provide the Bank electronic information about the status of the cartridge.

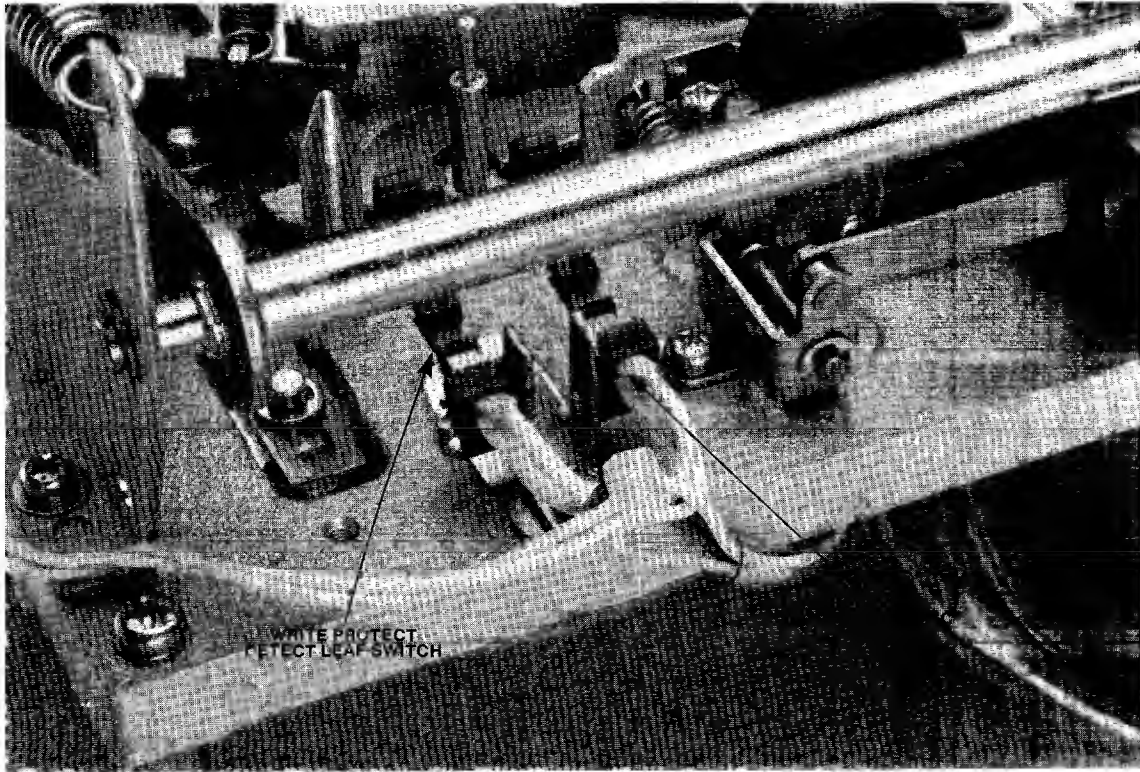


Figure 5-6. Leaf Switch Locations

#### 5.5.1 Cartridge Detect Switch

The cartridge holder must be attached to the support assembly and locked in the loaded position to make this adjustment. The gap measurement is checked between the linkage of the ejector lever and the face of the leaf switch (see figure 5-7). The gap should be checked with a feeler gauge; it should be 0.02 inches (0.5 mm). If an adjustment is necessary, loosen the mounting screw and move the switch until the proper gap is obtained. Retighten the mounting screws.

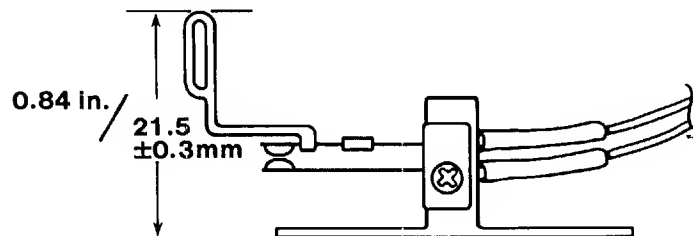


Figure 5-7. Cartridge Detect Switch Adjustment



### 5.5.2 Cartridge Placement Switch and Write Protect Switch

Adjustment procedures for both of these switches are the same. The measurement is taken from base of the tape drive to which the switches are mounted, to the top of the each leaf switch. It is the top on these switches that comes in contact with the cartridge and activates the switch signal. The correct height is 0.84 inches (21.5 mm). To adjust the height, the phillips screws mounting the switches should be loosened, the proper distance measured, and the mounting screws should be retightened.

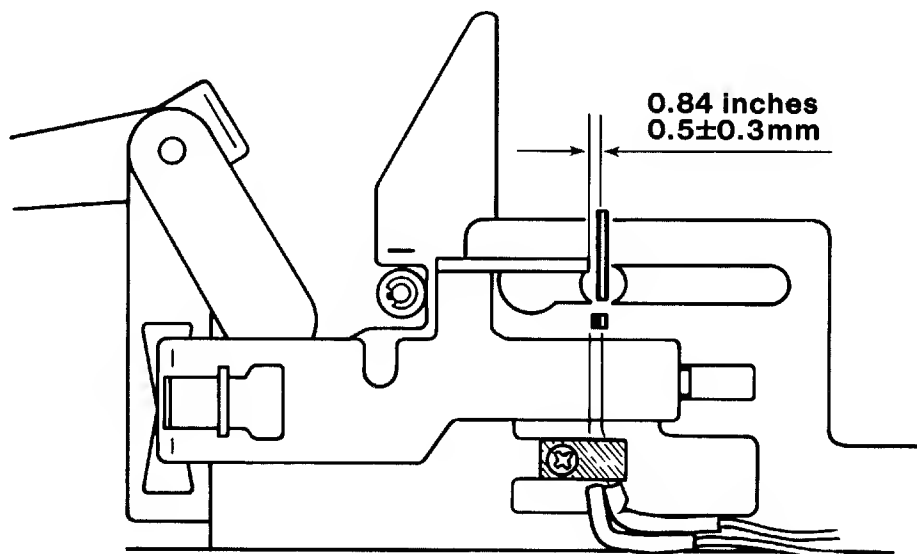


Figure 5-8. Placement Detect and Write Protect Switch Adjustment

### 5.6 Electrical Adjustment

The servo board has one adjustable potentiometer which controls the servo motor speed. **THIS IS THE ONLY ELECTRICAL ADJUSTMENT ON THE BANK.** This should be adjusted if the servo motor speed is suspected of being out of specification or whenever the servo board is replaced.

The servo adjustment is a voltage amplitude adjustment and the object of the adjustment is to set the two signals to a common voltage level.

To perform this adjustment the top encasement must be removed from the Bank. The tape cartridge holder must then be remounted on the support assembly. All other modules should be securely in place. The AC power cord should be plugged in. The AC power should be OFF while connecting the scope probes.

1. The test points are on the lower righthand corner of the servo board when viewed from the front of the Bank. Connect the scope probes and set the oscilloscope as follows:

- Channel 1 ..... TP2—1V/Div\*
- Channel 2 ..... TP3—1V/Div\*
- Ground ..... TP1
- Time/Div..... 0.2ms/Div
- Display..... Chop
- Trig Mode ..... Auto

\*Note: If a 10:1 probe is used, set the voltage to 0.1v/Div.

2. Turn on the AC power.
3. Place any formatted cartridge in the cartridge holder and lower it into place. Enter the diagnostic program and run VERIFY. (Setting the parameters to VERIFY all tracks will provide the necessary signals for at least one-half hour, long enough to complete the adjustment.)
4. Set channels 1 and 2 to the GND range. Adjust the vertical position of each channel so that both converge on the bottom of the scope display graticule.
5. Set channels 1 and 2 of the scope to the DC range. Both signals will be displayed on the screen and should appear above the ground level. If the two signals are convergent, no adjustment is needed.
6. To adjust unequal signal amplitudes, adjust VR1 until both signals converge at the same voltage. See figure 5-11 below.

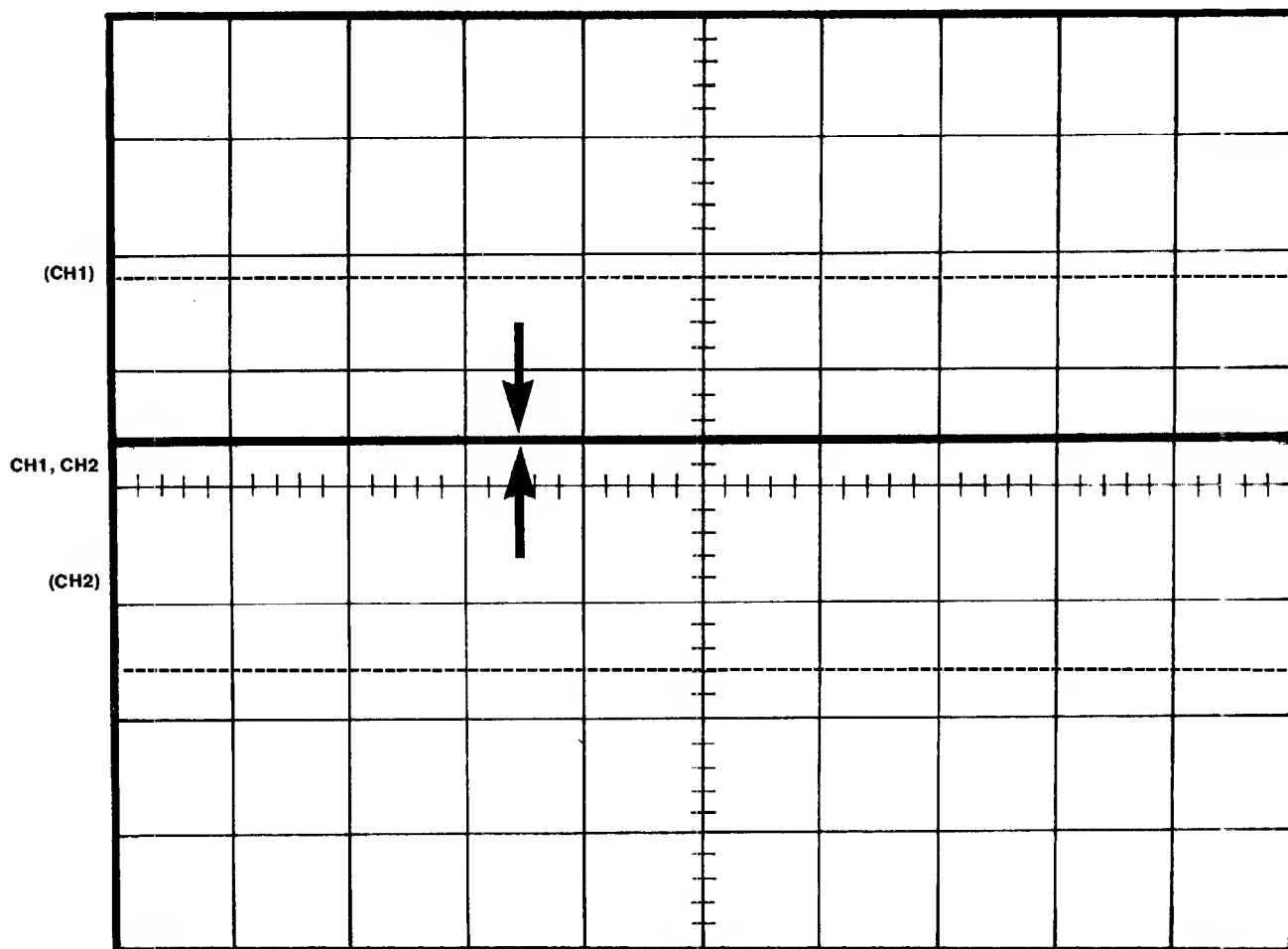


Figure 5-9. Servo Motor Speed Adjustment

**CAUTION:**

**Make only small adjustments allowing a few seconds settling time. Making too large an adjustment can cause the servo motor to spin outside the lock range. This can cause the tape to become unevenly wound or jammed.**



**CHAPTER 6**  
**TROUBLESHOOTING**



## CHAPTER 6 TROUBLESHOOTING

### 6.0 Scope of Chapter

This chapter describes troubleshooting techniques for the Bank. The procedures described in this chapter should be used in conjunction with the troubleshooting flowchart in appendix D.

### 6.1 Introduction

The Bank may indicate errors in several ways during power up or during normal operation. These include:

- Front Indicators
- Error Messages
- Electrical Malfunction
- Mechanical Malfunction

When approaching a problem with the Bank, it will be necessary to refer to the troubleshooting flowchart in appendix D of this manual. By referring to the flowchart the servicing technician will be directed to a section in this chapter which will describe the procedures necessary to determine the fault. If performing these procedures does not isolate the problem, refer back to the flowchart and perform the next logical checkout.

Various faults may display similar symptoms in which case it will be necessary to perform checks in several areas. Each fault indication and method of remedy will be discussed separately in the following sections.

Error codes are listed in appendix C of this manual.

### 6.2 Front Panel Indicators

The front panel contains three LEDs which display varying conditions of the Bank. These LEDs are illustrated in figure 1.3 in chapter one.

Proper indication of these lights and operation of the Bank can be found in the Bank manual, but generally during power on, the BUSY light should be on until the end of initialization. At that time, only the READY light should be lit, indicating the Bank is ready for a command.

Table 6-1 shows the conditions and associated LED indications when the Bank is in the prep mode, to format a tape or to update firmware. These light conditions are not error indications but indications that a command is being performed.

- Bank in Prep Mode
- Tape is formatting
- Bank is filling during format
- Tape is verifying during format
- Bank is executing commands in prep

FAULT LED	BUSY LED	READY LED
On	Off	On
On	On	On
Off	On	On
Off	On	Off
Off	On	Off

Table 6-1. Indicator Operating Conditions

In the event that the front panel lights do not function normally an error has occurred and some troubleshooting will be necessary. The lights may display the following conditions:

	FAULT LED	BUSY LED	READY LED
● Condition 1	Off	Off	On
● Condition 2	Off	Off	Off
● Condition 3	On	On	Off
● Condition 4	On	On	On
● Condition 5	Off	On	On
● Condition 6	FLASH	Off	Off
● Condition 7	FLASH	FLASH	FLASH

**Table 6-2. Indicator Error Conditions**

Condition 1—FAULT light is off, BUSY light is off and the READY light is on.

- Indicates the desired panel light condition for Bank operation. With this condition the Bank is 'Ready' for operation.
- If the situation arises where the READY light is on but the Bank cannot be accessed from your computer, the problem may be in the hardware link. Check to see that the OMNINET address switches are set properly and that you are addressing the correct address of the Bank.
- Verify that the Bank is being recognized by the network. This can be done by running the WHO option of OMNINET test from the drive diagnostics. More information about this test can be found in the Networks Service Manual.
- A hardware failure may also prevent communication between the Bank and the computer. Modular substitution should be performed to isolate the problem.

Condition 2—All front panel lights are off. There are various situations which may cause this condition:

- No tape is in the Bank.
- Cartridge holder is not completely seated. A cartridge holder lubrication may be needed or a leaf switch adjustment may have to be performed. See sections 5.4 and 5.5 for instructions.
- Electrical problem—Power may not be present. Section 6.3 describes the electrical checkout procedure.
- A jammed tape can cause this indication. Replace the tape with a new tape and retry.
- The LEDs on the front panel may be blown. This would require that the front panel be changed. The procedure for this may be found in section 3.2.3.
- A severe hardware malfunction may also cause this type of indication. Modular substitution should be performed as described in section 6.4 of this manual.

Condition 3—FAULT light on, BUSY light on, and the READY light is off.

- The firmware on the tape may not be installed or it may have been corrupted. In this case it will have to be updated from the Bank diagnostic program.

Condition 4—All lights are on.

- This indication may be caused by a duplicate OMNINET network addresses. In this case an address not assigned to any other device must be selected as the Bank unique address.
- A condition of this sort may also indicate a hardware failure.

Condition 5—FAULT light is off, BUSY light is on, and the READY light is on usually indicates that the tape is unformatted.

Condition 6—FAULT light flashes, BUSY light off and the READY light is off. This type of error usually indicates that there is a hardware mismatch. Check PROM and ROM revision levels for compatibility. Check the transporter version.

Condition 7—RAM error, substitute OMNINET controller board.

### 6.3 Electrical Checkout Procedure

An electrical checkout of the Bank may be necessary in the event that a malfunction has occurred. This checkout has been divided into the following sections:

- Fuse
- Power Switch
- Power Supply and Harness

#### 6.3.1 Fuse Checkout and Replacement

You may need to check and change the fuse if your Bank indicator lights are not working. Check the fuse and replace it if it is burned out. To change the fuse, follow the steps below.

1. Turn off all equipment.
2. Unplug the Bank.
3. Remove the fuse holder from The Bank. The fuse holder is just above the power socket on the back of the Bank. Slide a small screwdriver under the holder's bottom lip. Twist the screwdriver to the right or left; the holder will pop out easily.
4. Check the fuses. Turn the fuse holder so that the bottom lip is pointed up. The holder has two slots for fuses. The three-sided slot contains the fuse in use; the four-sided side contains the spare fuse. Check to see if the three-sided slot contains a defective fuse. The fuse is defective if its internal wire is broken or its casing is clouded.

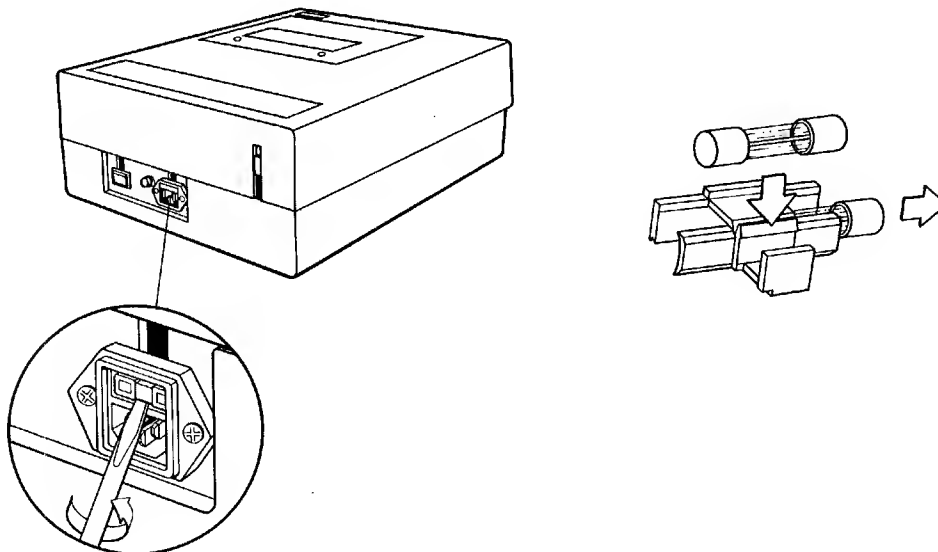


Figure 6-1. Fuse Replacement



5. To remove a defective fuse, press up on one end of the fuse; the fuse easily pops out of the slot's top.
6. To remove the spare fuse, slide the screw driver through one of the open ends of the four-sided slot; the spare fuse pops out the other end.
7. Insert the spare fuse in the three-sided slot. Press the spare fuse into the top of the three-sided slot. The fuse clicks as it locks into the slot.
8. Replace the spare fuse.

If the fuse continues to blow after replacement, a more severe problem is indicated and replacement of the switch may be necessary.

### 6.3.2 Power Switch

The tape cartridge holder and the top encasement must be removed before the power supply switch can be checked. See section 3.2. for disassembly instructions.

#### **WARNING:**

***Extreme caution should be exercised when testing the power switch, power supply, and wire harness. High voltages present a potential hazard.***

The switch may be checked by performing a continuity check of the wires connecting the switch to the AC input connector and connector leading to the power supply. The diagram below illustrates the check point A and B for verifying proper switch operation.

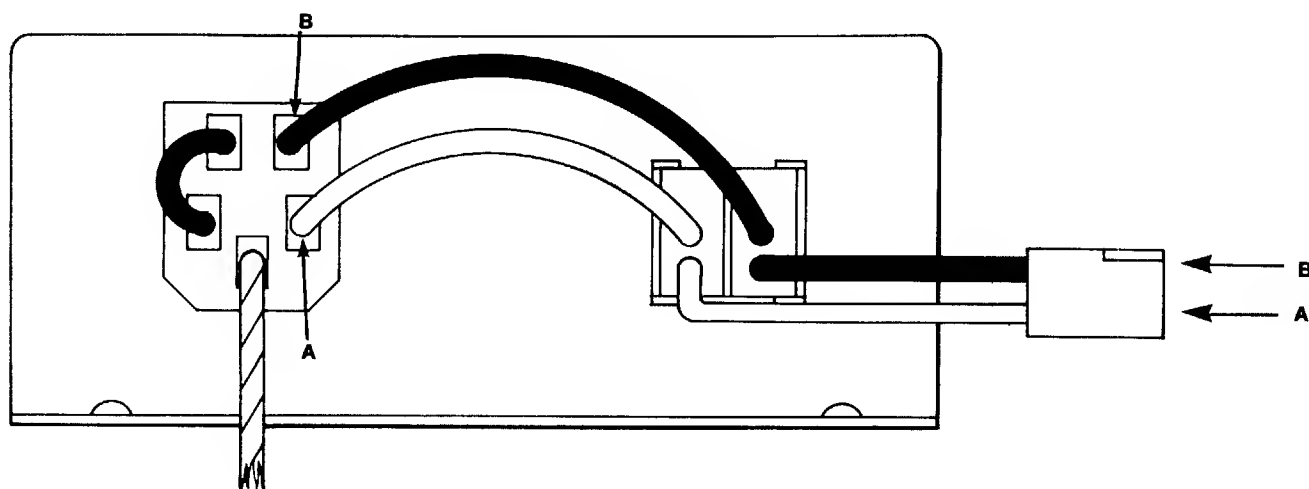


Figure 6-2. Power Connector and Switch Assembly

The continuity tester should be set to check points A. Turn the switch off and on. The tester should change from an indication of continuity to an indication of no continuity.

Next, set the tester to test points B and repeat the continuity test for these points.

If the switch does not respond as indicated, replace the AC input and switch unit.

### 6.3.3 Power Supply and Harness

You will need an accurate voltage meter to measure the voltage levels. These voltages should be measured at the board connectors, this will verify that the harness is delivering the voltages to the boards.

There are no adjustments possible on the power supply. If any of the measured voltage levels are more than 0.1V out of tolerance, the power supply must be replaced. Replacement of the power supply is described in section 3.2.8 of this manual.

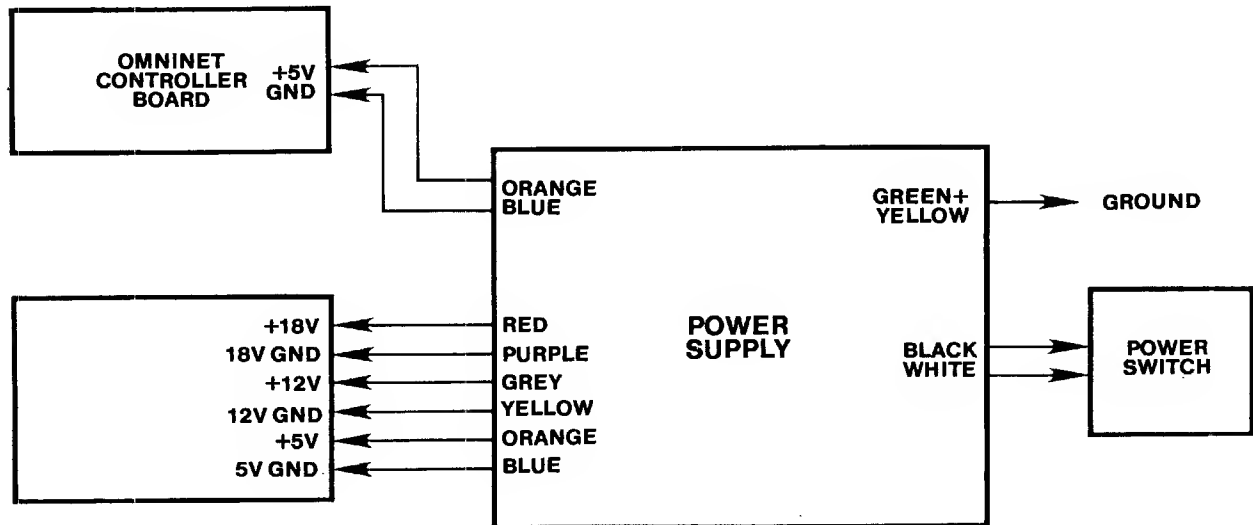


Figure 6-3. Power Harness

There are two versions of the AC power connector: one for 110/120 VAC input and another for 220/240 VAC. These connectors are described in table 6-3.

Power Supply (110/120 VAC)			Power Supply (220-240 VAC)		
Pin	Color	Voltage	Pin	Color	Voltage
1	White	85-130 VAC	1	White	187-264 VAC
2	Not Used		2	Not Used	
3	Black	85-130 VAC	3	Black	187-264 VAC

Table 6-3. AC Power Connector

#### 6.4 Modular Substitution Procedures

Modular troubleshooting of the Bank is simple due to the limited number of subassemblies within the Bank. These subassemblies are:

- OMNINET Bank Controller Board
- Read/Write CPU Board
- Servo Board
- Front Panel LED Board
- Bank Tape Drive Mechanism

The Bank spares kit is available from the Corvus Customer Service Department. It includes all the major components needed for modular replacement.

Prior to modular substitution, perform the following set-up.

1. Power down the Corvus Bank and disconnect the power cord.
2. Remove the OMNINET tap cable.
3. Follow the disassembly procedures described in chapter three and remove the Bank from the top and bottom encasements.
4. Boards should be replaced in the sequence in which they are listed above.

#### **6.4.1 OMNINET Bank Controller Board**

The OMNINET Bank Controller board is the main link to the OMNINET local area network and to the microcomputers which are connected to the network. A detailed description of the Controller board can be found in chapter 2 of this manual.

If communication with the Bank is a problem perform the following steps:

1. Verify that the OMNINET local area network is in good working order.
2. Check the Bank guide to be sure that you have the right software to run the Bank and are using proper operation methods.
3. Check the installation of the Bank including connectors and network address switches.
4. Remove the OMNINET Controller board as described in chapter three section 3.2.4.
5. Install a known good OMNINET Controller board, reinstall the cartridge holder, tap cable and the power cable.
6. Insert a known good tape.
7. Power up the Bank and run a version check from the diagnostics. If this does not work go to section 5.3.2.

If the OMNINET Bank Controller board is found to be bad, the spares kit contains spare components which can be replaced. These components are socketed LSI chips.

The OMNINET circuitry controls communication with the rest of the network. The socketed OMNINET components are:

- Transmitter (U101)
- Receiver (U201)
- Advanced Data Link Converter (ADLC) (U102)
- 6801-1 Microprocessor (U103)
- Corvus Monochip (U302)

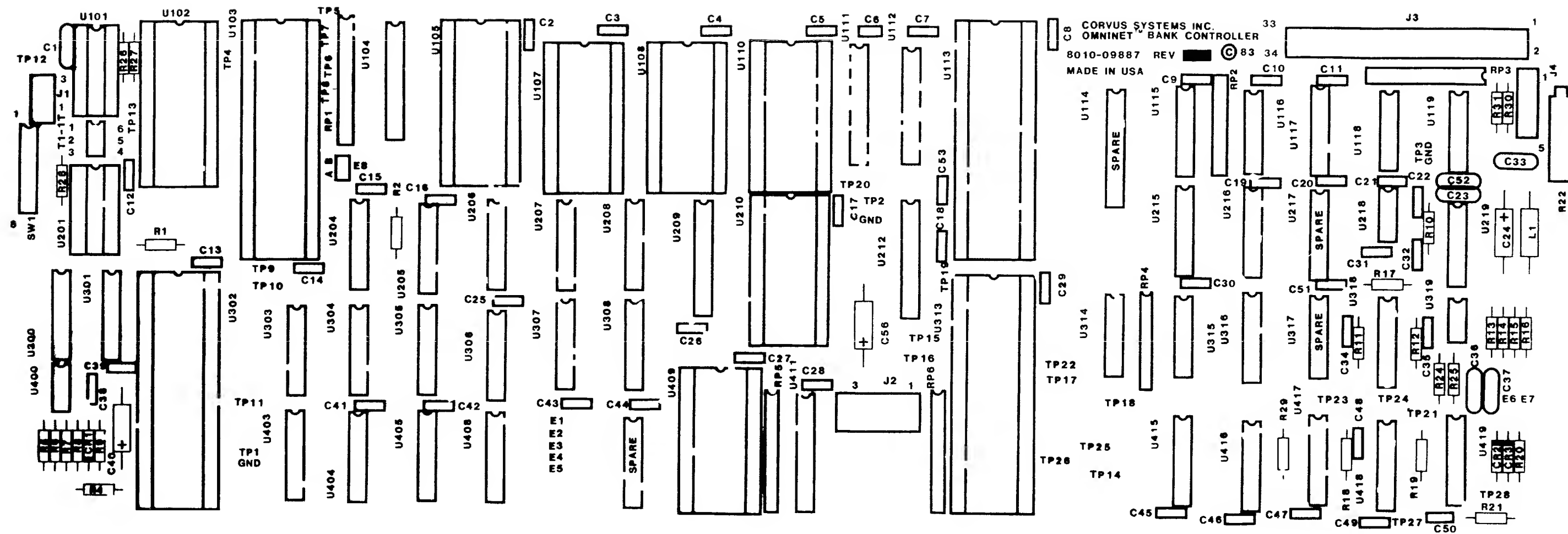


Figure 6-4. OMNINET Bank Controller

These chips should be replaced one at a time in the sequence in which they are listed above until the malfunctioning chip is found.

The remaining socketed components perform link and control functions between the microprocessor and the Bank tape drive mechanism. The replaceable Control components are:

- WD1010 (U313)
- ROM (U105)
- Static RAMS (U107,U108,U210,U409)
- Versatile Interface Adapter (VIA) (U313)

If exchanging these chips does not remedy the problem, the entire board must be replaced.

#### **6.4.2 Read/Write CPU Board**

The Read/Write CPU board controls the read and write functions of the tape mechanism. It uses an Intel 8749 microprocessor as a controller and receives commands directly from the OMNINET controller board. A detailed description of the Read and Write CPU board can be found in chapter two.

The replacement procedures are:

1. Replace the Read/Write CPU board as described in section 3.2.5 of this manual.
2. Reinstall the tape cartridge holder, tap cable, and AC power cable.
3. Power up the Bank. From the diagnostic program, run the NAME command. The command will write to the tape and read the tape name which you have written. Instructions for using the NAME option can be found in the Bank guide.
4. There are no components on the Read and Write CPU board which can be replaced. The board is considered a complete replacement module.

#### **6.4.3 Servo Board**

The servo board controls the servo motor in the tape mechanism. If the tape rotation is erratic or if the motor does not turn, the servo board should be adjusted (see section 5.6). Use a known good tape. If the adjustment does not improve the performance, the servo board should be replaced.

When the servo board is replaced, an adjustment should be performed. Servo adjustment procedures can be found in section 5.6.

Instructions for replacing the servo board can be found in section 3.2.6.

#### **6.4.4 Tape Drive Mechanism Replacement**

If replacement of all other modules has not resulted in proper Bank operation, the last module that should be substituted is the tape drive mechanism.

1. Prior to replacing the tape mechanism, clean the head as described in section 5.3.1 and perform a NAME command. If the Bank now functions properly, the tape mechanism will not need to be replaced.
2. Replace the tape drive mechanism as described in section 3.2.10.
3. Verify that all connectors are replaced firmly and properly.
4. Power on the Bank and perform the NAME command.



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**CORVUS DEALER SERVICE**

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**APPENDIX A**  
**GLOSSARY**

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## APPENDIX A

### GLOSSARY

**ADLC:** Advanced Data Link Controller. All Servers and transporters contain an ADLC; acts as an interface to the network trunk. Performs parallel to serial conversion when transmitting, and serial to parallel conversion when receiving.

**AMPLIFIER:** An electronic circuit which increases a signal.

**BIT:** Single binary digit. Smallest unit of data; it has a value of one or zero.

**BYTE:** A multi-bit digital value, usually 8 bits long.

**BLOCK:** A group of data bytes. A Corvus block contains 512 Bytes, the equivalent of one sector on the disk.

**CARTRIDGE HOLDER:** Part of the tape mechanism which holds the tape cartridge and places it in position for writing and reading.

**CPU:** Central Processing Unit. In a microcomputer, an integrated circuit which performs the arithmetic, logical, and control functions necessary to execute the individual instructions of a program.

**BUFFER:** Temporary storage used to compensate for a difference in the rate of data flow or time of event occurrence.

**CONSTELLATION:** Constellation refers to the network management software used for OMNINET or the Multiplexer.

**CRC:** Cyclic Redundancy Checksum. An error checking technique.

**DIP SWITCH:** DIP is the abbreviation for Dual-in-line Packaging. These two-position switches are used to set the address of the Bank, Host, Disk Server, or any other network device.

**DIRECT MEMORY ACCESS (DMA):** The ability to read or write data from a host's memory to an external device without involving the Central Processing Unit (CPU).

**FIRMWARE:** The software for the Bank or Disk controller; it is called firmware because it is not changed during normal use. Firmware is also called Controller Code.

**GAIN:** The factor by which an amplifier increases an electronic signal.

**HEAD (physical):** A magnetic coil on a movable assembly which writes and reads the data on a magnetic disk or tape. Commonly called a Read/Write head.

**HEAD (Tape Segment):** Denotes a physical section of a tape. Each head contains 256 sectors. There are 4 heads on a 100-MB tape and 8 heads on a 200-MB tape.

**HEADER:** A record of data preceding the data written on a block or sector of a disk or tape. The header contains information the controller needs to locate the desired blocks or sectors, and check the data for errors.

**HOST:** A microcomputer connected to a network via a transporter.

**INDEX:** A starting point indicated by the position of a device which, when sensed electronically, establishes the beginning of a sector or track.

**INTERLEAVE:** The Interleave factor causes the head to skip a preset number of sectors on the tape or disk when reading or writing data. The incorrect interleave factor causes delays of Bank operations, slowing performance to unacceptable levels.

**LEAFSWITCH:** An electrical switch consisting of two pieces of metal which, when actuated by pressure, forces one half to be moved away from the other, breaking the circuit. The leaf then springs back to its original position when pressure is removed.

**LED:** Light Emitting Diode. Used to indicate the condition or status of electronic circuitry.

**MASS STORAGE:** Refers to a magnetic disk or tape device used to store large amounts of computer information permanently.

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## CORVUS DEALER SERVICE

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**MONOCHIP:** An integrated circuit designed by Corvus to synchronize Direct Memory Access operations by an OMNINET Server or Transporter.

**NETWORK:** A group of nodes interconnected with a trunk line, which connects host computers to shared peripheral devices.

**NODE:** A point at which any network device is connected to the network trunk.

**OMNINET:** A local area network by Corvus Systems, Inc. which allows shared access to peripherals via Transporters and Servers.

**RANDOM-ACCESS MEMORY (RAM):** A read/write memory device (usually an integrated circuit) used to store data.

**READ-ONLY MEMORY (ROM):** Usually an integrated circuit which stores information which can not be altered even when power is removed.

**SECTOR:** A logical grouping of data on a disk or Bank tape. For the Bank there are 1024 sectors in each track on a 100 MB tape, and 2048 sectors in each track on a 200 MB tape.

**SERVER:** A Corvus intelligent network device which serves as an interface between the network and a disk drive, printer, or modem.

**SERVO:** An electronic circuit which controls a motor or solenoid precisely; commonly used in computer peripheral devices of all types.

**SERVO MOTOR:** The motor in the Bank that controls the tape motion.

**SOLENOID:** An electro-mechanical device which, when energized by an electric current, actuates a mechanical arm or lever.

**STEPPER MOTOR:** A motor which rotates in discrete steps, in response to electrical current pulses. Used in the Bank mechanism to position the read-write head over the desired track.

**TAP BOX:** OMNINET device which physically connects each device to the trunk via a tap cable at each node.

**TRACK:** A longitudinal unit of data on a tape. A Bank tape has 101 tracks in parallel; on a 100 MB tape each track contains 1024 sectors, and a 200 MB tape has 2048 sectors per track.

**TRANSPORTER:** A Corvus intelligent network device which connects a Host computer to the network.

**TRUNK:** The main part of the network cable to which the tap boxes are connected.

**APPENDIX B**  
**FIRMWARE**



## **APPENDIX B FIRMWARE**

The first 38 blocks of track 1 are designated as the firmware area. This area contains special information about the system. The first three blocks are recorded three times and contain the same information. The triple redundancy recording of these blocks provides backup for safety. These blocks are called boot blocks.

To read and write to the firmware area, the tape must be in the prep mode and send firmware read and write commands. The firmware uses only the first 512 bytes of the physical sector. No blocking or deblocking is done for this area as is done in the user area.

Block 0	Boot Block
Block 1	Spare sector table
Block 2	Reserved
Block 3	Constellation block
Block 4,5	Reserved
Block 6,7	Dispatcher
Block 8	Pipe name table
Block 9-11	Diag block 0,1,2
Block 12-19	Reserved
Block 20-24	Reserved
Block 24-231	Concept and Apple boot blocks
Block 32-35	Constellation II temp blocks
Blocks 36 and 37 are for future expansion	

**APPENDIX C**  
**ERROR CODES**

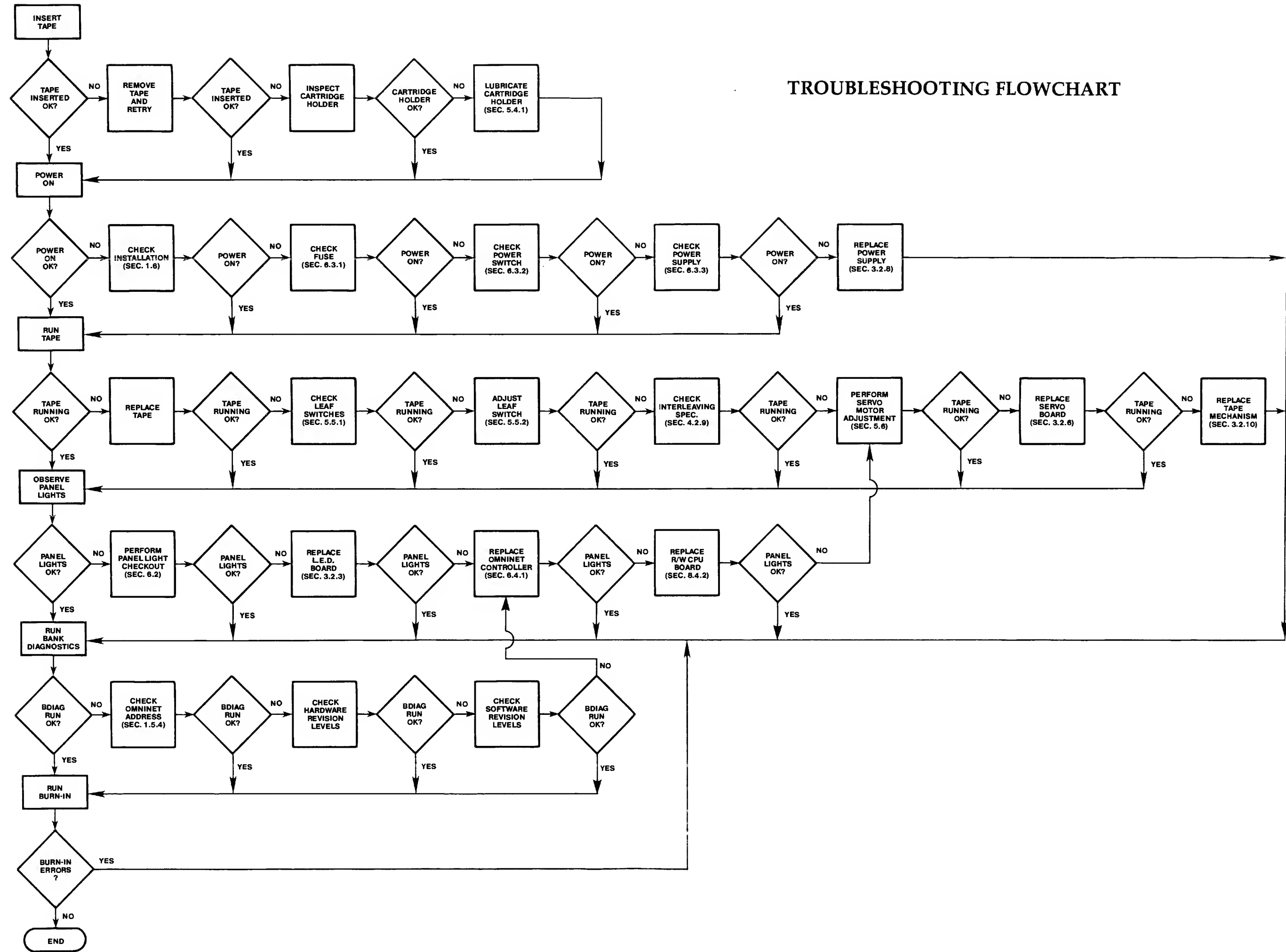
## APPENDIX C ERROR CODES

Hex Error Codes	Bank Errors
83H	Seek Error
2BH	Soft CRC Error (data)
8BH	Hard CRC Error (data)
24H	Soft Sector Header Error
84H	Hard Sector Header Error
8EH	Illegal Sector Address
8FH	Illegal Opcode
87H	Drive Not Ready
9DH	Format Firmware Track Failure
9EH	No Tape Inserted
9FH	Cannot Read Boot Block
0FFH	No Room in Active User Table
0FFH	Duplicate Name in Active User Table
OBEH	User Not Found in Active User Table
4	Drive Not Initialized (Const II)

**APPENDIX D**  
**TROUBLESHOOTING FLOWCHART**



TROUBLESHOOTING FLOWCHART



**APPENDIX E**  
**BANK SPARES KIT**

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**CORVUS DEALER SERVICE**

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**APPENDIX E  
BANK SPARES KIT**

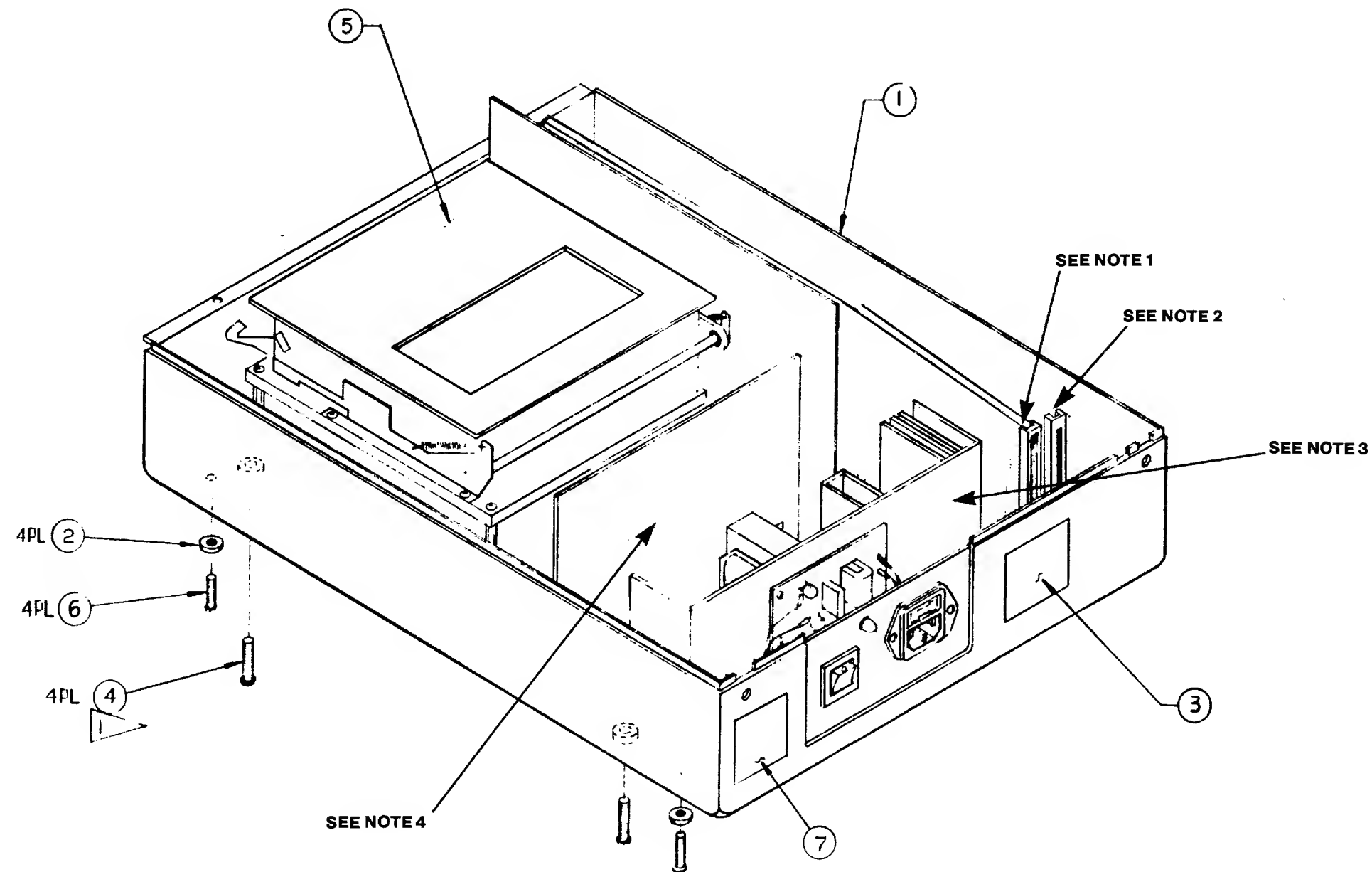
<b>Boards</b>	<b>Part Number</b>	<b>Quantity</b>
LED	8010-09778	2
OMNINET Controller	8010-09887	1
R/W CPU	8010-09785	1
Servo	8010-09786	1
<b>Chassis</b>		
Bank Deck	8010-09784	1
<b>CABLES</b>		
LED Board	8015-09788	1
TEC Interface	8015-09787	1
RESET Switch	8010-09796	1
<b>Power Supply</b>		
LM110 (120)	8010-09780	1
or		
LM110 (220)	8010-09781	1
<b>Socketed Chips</b>		
IIT 75174	3210-01271	1
IIT 75175	3210-01272	1
IUC 6801-1/T9.B	3265-04928	1
IUC WD1010	3265-04934	1
SAS PROM BKB 260	8105-10557	2
Monochip	8115-03023	1

**APPENDIX F**  
**ASSEMBLY DRAWINGS**

**List of Materials for Base Assembly  
8010-09793**

<b>Item</b>	<b>Description</b>	<b>Part Number</b>
1	Not Available	
2	Not Available	
3	Not Available	
4	Not Available	
5	Bank Deck	8010-09784
6	Not Available	
7	Not Available	
Note 1	R/W CPU Board	8010-09785
Note 2	OMNINET Bank Controller	8010-09887
Note 3	LM110 (120 VAC)	8010-09780
	or	
	LM110 (220 VAC)	8010-09781
Note 4	Servo Board	8010-09786

REVISIONS				
PCO	REV	DESCRIPTION	DATE	APPROVED
1256	A	REL. TO PROD.	11-18-83	



1 INSERT IN BOSS ON INSIDE OF BASE ASSY.

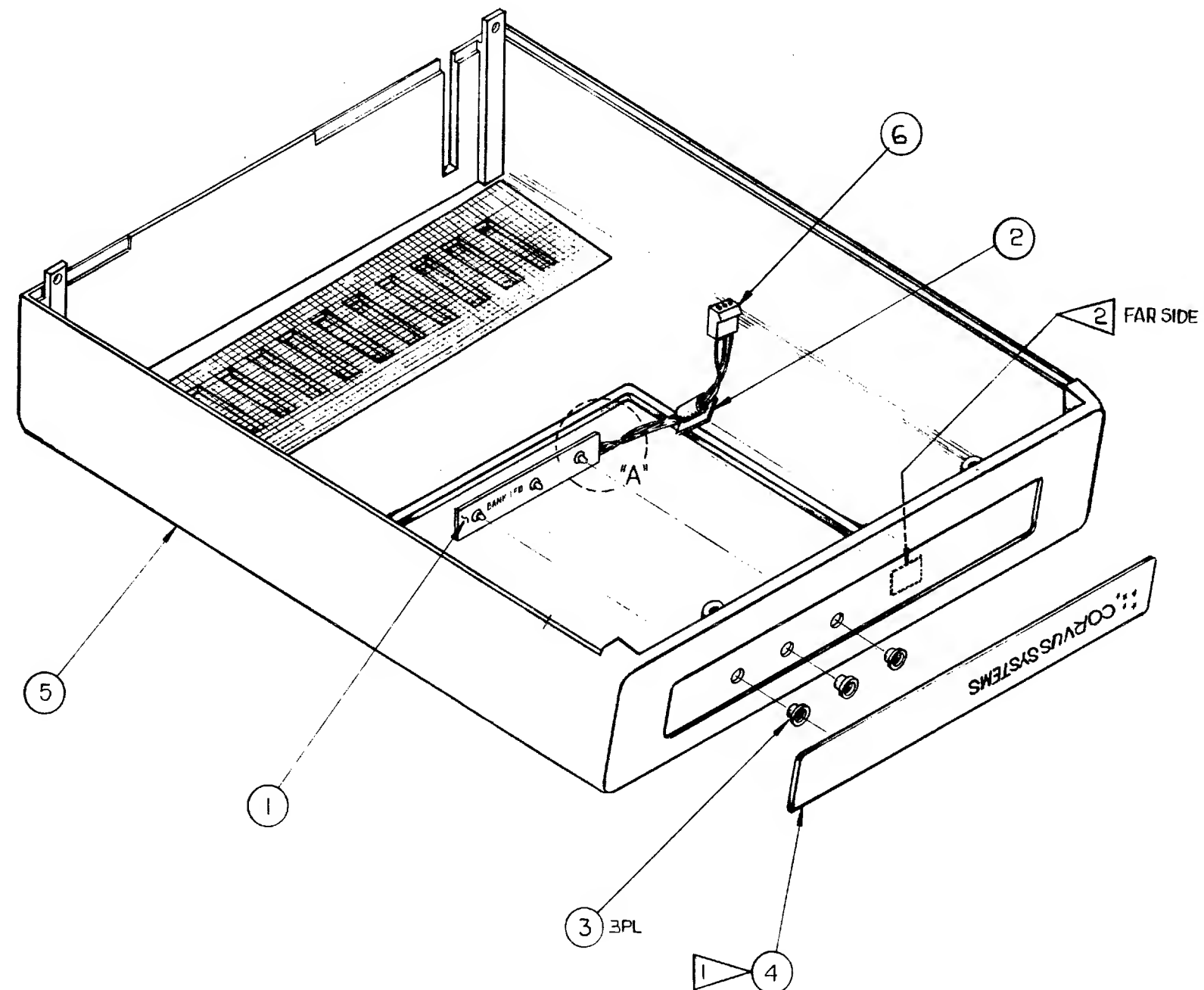
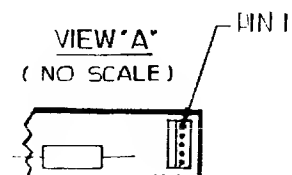
NOTE :



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		ANGLES DECIMALS ± .XX ± .XXX ±		DRAWN BY H. ELLI		DATE OF DRAWING 5-16-83	
		MATERIAL		CHECKED BY [Signature]		ENGINEER R. LAMERON	
6011 19775 BANK		FINISH		APPROVED [Signature] 11/18/83		BASE ASSY, FOAM 220V BANK	
NEXT ASSY USED ON				APPROVED		REV. A	
APPLICATION						ASSY DWG. 6010-02793	
						SCALE 1:1	
						SHEET 1 OF 1	

**List of Materials for Top Assembly  
8010-09779**

<b>Item</b>	<b>Description</b>	<b>Part Number</b>
1	LED Board	8010-09778
2-5	Not Available	
6	LED Board Cable	8015-09788

REVISIONS				
PCO	REV	DESCRIPTION	DATE	APPROVED
1256	A	REL. FOR PROD.	Hug 11-18-83	



-  PLACE CABLE CLAMP IN APPROXIMATE POSITION AS SHOWN BY DOTTED LINES. NOTE: CLEAN LOCATION BEFORE ATTACHING CLAMP.  
 CENTER OVERLAY IN COVER INDENTATION.

NOTES: UNLESS OTHERWISE SPECIFIED.

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON		This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS.		<b>CORVUS SYSTEMS</b> 2029 O'Toole Avenue, San Jose, CA 95131	
		ANGLES    DECIMALS ±        .XX ± .XXX ±		DRAWN BY H. BUI ENGINEER		DATE OF DRAWING 5-18-83	
8005-09775    BANK		MATERIAL		APPROVED <i>Ben Lerner</i> 11/18/83		FRAME TOP ASSY, BANK 120V	
8005-09774    BANK		FINISH		APPROVED		REV. A	
NEXT ASSY    USED ON						ASSY DWG.    8010-02779	
APPLICATION						SCALE    NTS    SHEET 1 OF 1	



REVISIONS			
PCO	REV	DESCRIPTION	DATE
1256	A	REL. TO PROD.	11-18-83

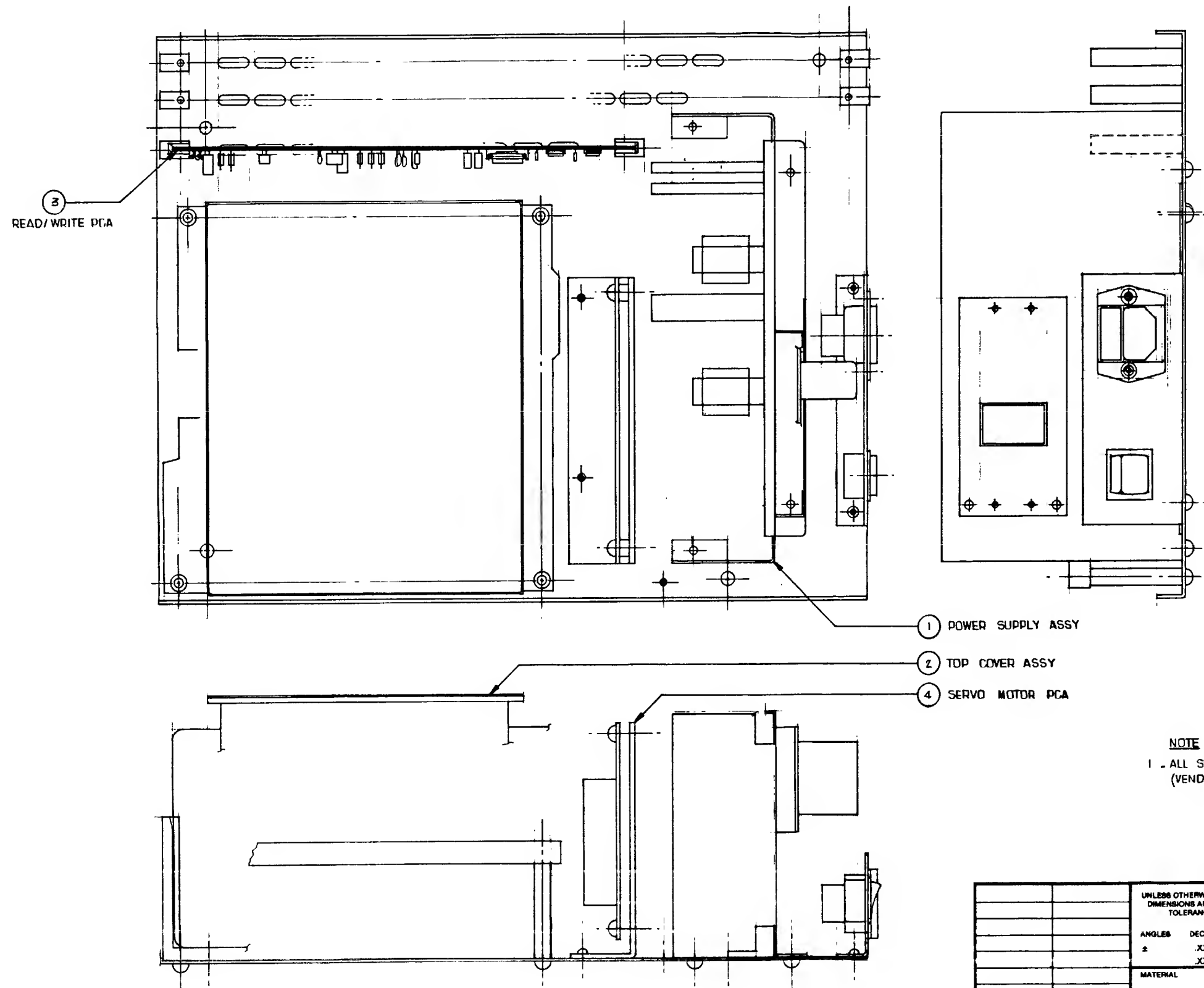
3  
READ/ WRITE PCA

- 1 POWER SUPPLY ASSY
- 2 TOP COVER ASSY
- A SERVO MOTOR PCA

NOTE :  
1. ALL SUB ASSEMBLIES SECURED USING METRIC  
HARDWARE (VENDOR SUPPLIED).

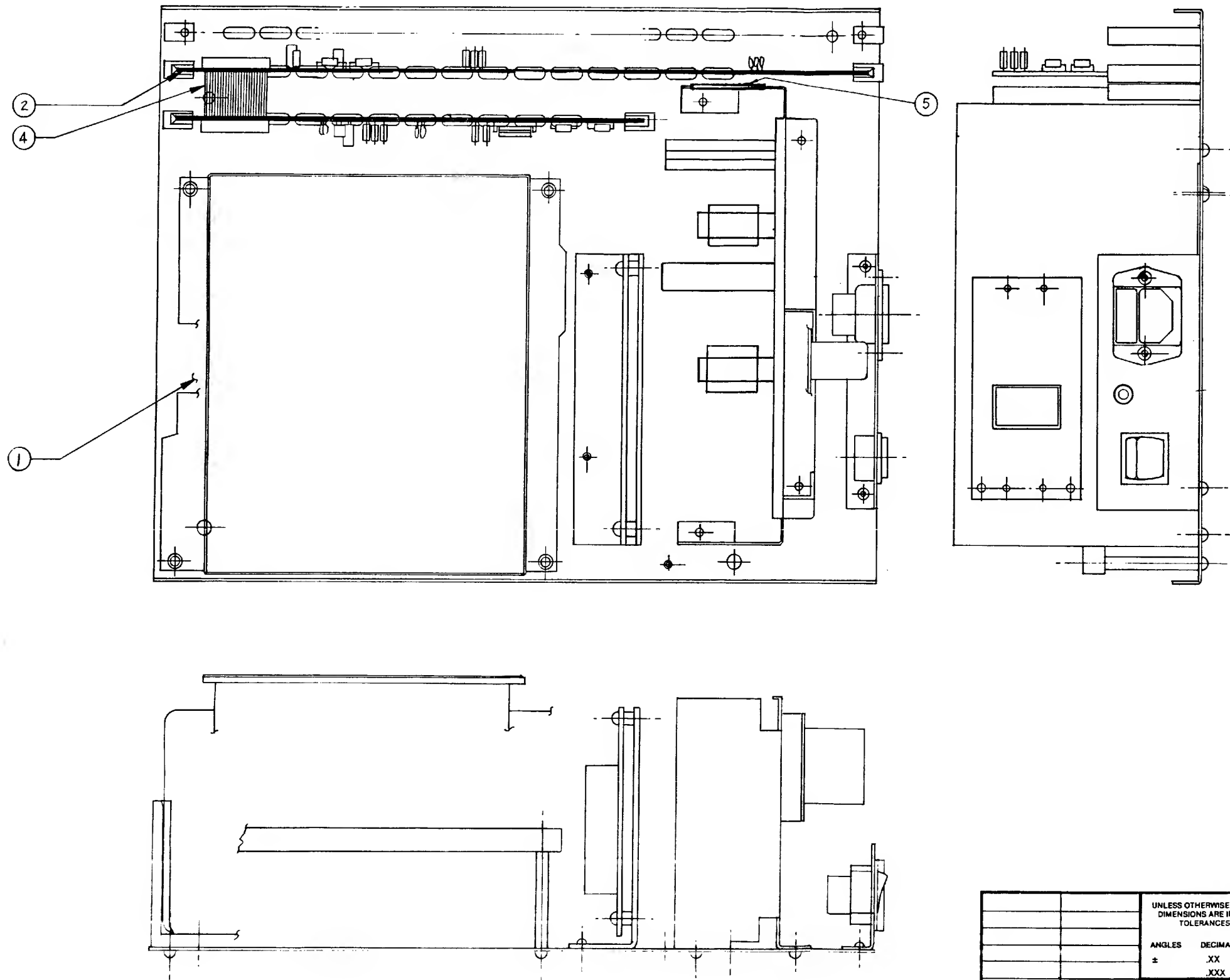
8010-09776 <b>BANK</b> NEXT ASSY USED ON APPLICATION		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES DECIMALS ± .XX ±. .XXX ±. MATERIAL FINISH	This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS DRAWN BY DWBATO CHECKED BY APPROVED DATE OF DRAWING 5-10-83 11/18/83	** CORVUS SYSTEMS ** 2029 O'Toole Avenue, San Jose, CA 95131 TITLE LM-120 AC 120V POWER SUPPLY ASSY. DWG. 8010-09780 SCALE N.T.S. SHEET 1 OF 1	REY A
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REVISIONS			
PCO	REV	DESCRIPTION	DATE
1256	A	REL. TO PROD.	Aug 11-83
APPROVED			



NOTE :  
 1. ALL SUB ASSEMBLIES SECURED USING METRIC HARDWARE  
 (VENDOR SUPPLIED)

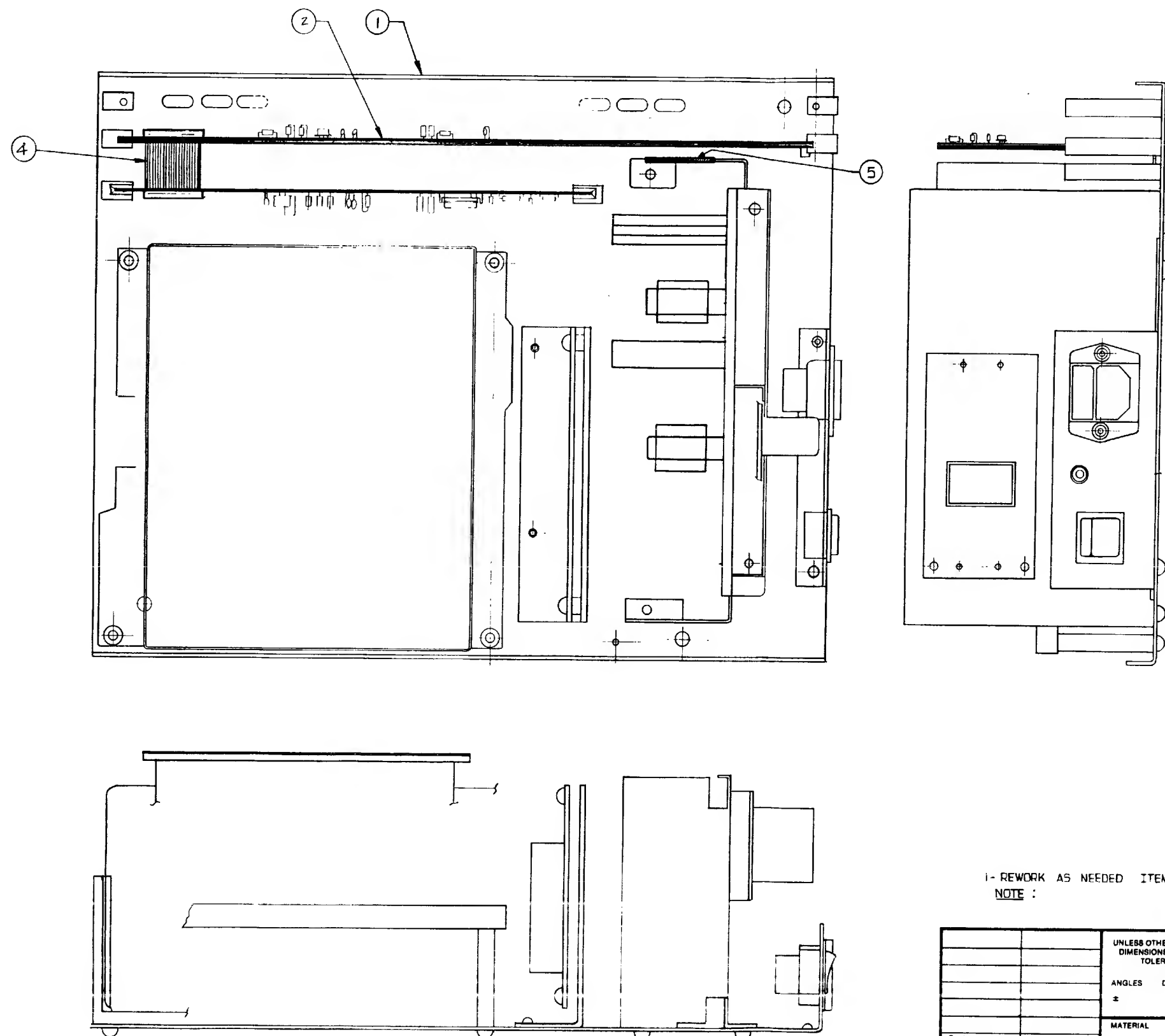
8010-09777 <i>BANK</i> NEXT ASSY USED ON		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES DECIMALS ± .XX ± .XXX ±	THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND IS DELIVERED UPON THE EXPRESSED CONDITION THAT IT WILL NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF CORVUS SYSTEMS. DRAWN BY <i>DMD</i> DATE OF DRAWING <i>3-15-83</i> CHECKED BY <i>[Signature]</i> ENGINEER <i>[Signature]</i> APPROVED <i>[Signature]</i> 4/1/83 APPROVED	** CORVUS SYSTEMS ** 2020 O'Toole Avenue, San Jose, CA 95131	
				TITLE: LM-110 AC 220V POWER SUPPLY REV A	
APPLICATION		MATERIAL	ASSY DWG	8010-09781	
FINISH		SCALE NTS	SHEET 1 OF 1		



REVISIONS				
PCO	REV	DESCRIPTION	DATE	APPROVED
	01	PRE-PRDD.	5-11-83	
	02	ADD ITEM # 5	5-26-83	
	03	ENG. CHG.	8-23-83 H.B.	
	04	REMOVE ITEM # 3	10-31-83 H.B.	
	05	BOM UPDATE	11-29-83	
	06	BOM UPDATE	12-15-88	

1. REF: REWORK INSTRUCTIONS ON BOM.  
NOTE:

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON	This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS.	☆☆ CORVUS SYSTEMS ☆☆ 2029 O'Toole Avenue, San Jose, CA 95131				
				ANGLES    DECIMALS	TITLE		REV:	
				±        .XX ± .XXX ±	DRAWN BY DMD/TL	DATE OF DRAWING 5-11-83	BANK ASSY. OPERATING 120V	06
					CHECKED BY	ENGINEER R.CAMERON		
		MATERIAL	APPROVED	ASSY. DWG.			8010-09776	
8010-09792	BANK	FINISH	APPROVED	SCALE    NTS		SHEET      OF		
NEXT ASSY	USED ON							
APPLICATION								

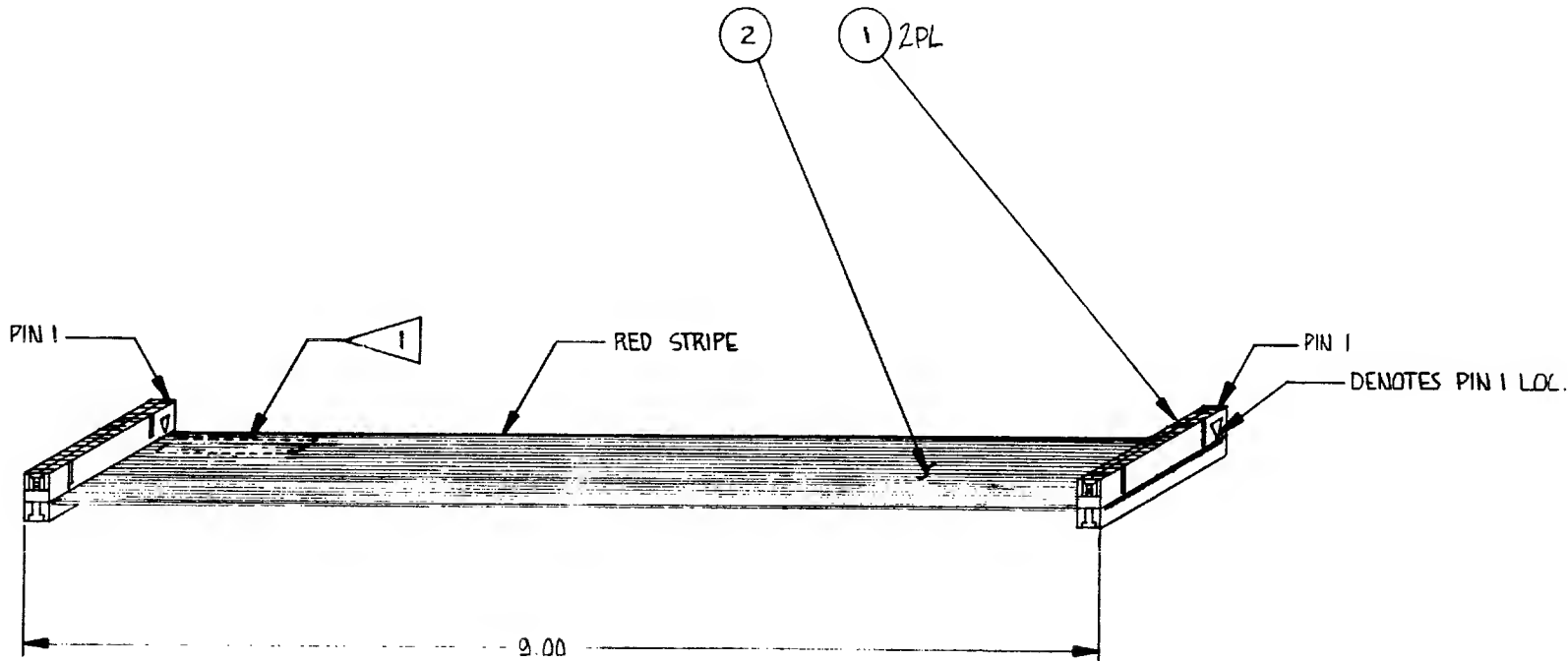


REVISIONS			
PCO	REV	DESCRIPTION	DATE
	01	PRE-PROD.	4-28-83
	02	ADD ITEM # 5	5-26-83
	03	ENG CHG	8-26-83 H.B.
	04	REMOVE ITEM #3	10-31-83 H.B.
	05	ADD NOTE 1	11-29-83 H.B.
	06	BOM UPDATE	12-15-83 H.B.

1- REWORK AS NEEDED ITEMS 6,7,8,11, 14 ON LIST OF MATERIALS.  
NOTE :

8010-09792		BANK		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES    DECIMALS ±            .XX ± .XXX ± MATERIAL FINISH		This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS DRAWN BY    H. B. CHECKED BY    R. C. DATE OF DRAWING    4-28-83 APPROVED APPROVED		★ ★ CORVUS SYSTEMS ★ 2020 O'Toole Avenue, San Jose, CA 95131		REV 06
NEXT ASSY		USED ON		APPLICATION		OPERATING ASSY 220V BANK ASSY DWG 8010-09777		SCALE    NTS SHEET    1 OF 1		

REVISIONS				
PCO	REV	DESCRIPTION	DATE	APPROVED
1256	A	REL. TO PROD.	11-18-83	



ITEM	QTY	CRVS PN	DESCRIPTION	MFG PN
2	1	6010-01415	CABLE, 34-POS. FLAT	3M 3365/34
1	2	2100-01076	CONN. 34-POS. SDC	3M 3414-6000

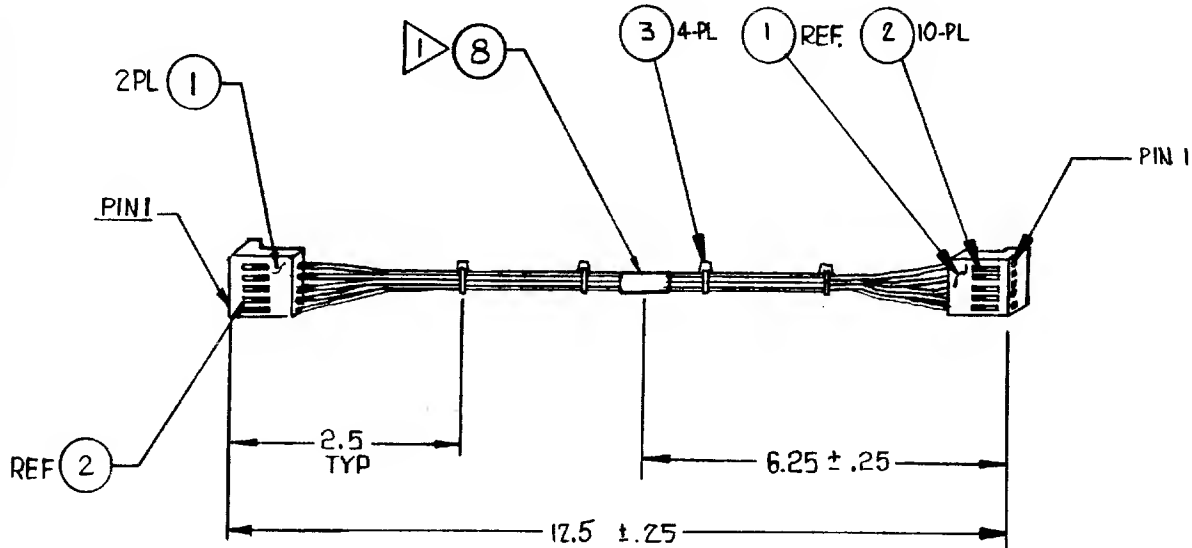
PARTS LIST

1 MARK P/N AND REVISION LEVEL IN .125  
BLK OR WHT. LETTERS WHERE INDICATED.  
(FAR SIDE)

NOTES:

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON		This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS.		<div> <div>★ ★ CORVUS SYSTEMS</div> <div>★ ★ 2029 O'Toole Avenue, San Jose, CA 95131</div> </div>	
		ANGLES    DECIMALS ±            .XX ± .25 .XXX ± .		DRAWN BY DMDATJ DATE OF DRAWING 5-13-83		TITLE CABLE ASSY TEL-TO-CORVUS INTERFACE	
		MATERIAL		CHECKED BY <i>[Signature]</i> ENGINEER		REV: A	
8010-09777    BANK 220V				APPROVED <i>[Signature]</i> 11/18/83		ASSY. DWG.    8015-09787	
8010-09776    BANK 110V				APPROVED			
NEXT ASSY    USED ON		FINISH					
APPLICATION						SCALE: FULL    SHEET 1 OF 1	

REVISIONS				
PCO	REV	DESCRIPTION	DATE	APPROVED
1256	A	REL. TO PROD.	11-18-83	



5	9	BLK	22
4	7	RED	22
3	6	YEL	22
2	5	GRN	22
1	4	WHT	22
PIN	ITEM	COLOR	AWG
CONN. CHART			

9	1	WIRE 22AWG BLK 12"	6000-0218	UL1430 SURFACE MARKED
8	1	TIE CABLE MINI MARKER	2800-02036	PANDUIT PLMIMNP
7	1	WIRE 22AWG RED 12"	6000-02219	UL1430 SURFACE MARKED
6	1	WIRE 22AWG YEL 12"	6000-02220	UL1430 SURFACE MARKED
5	1	WIRE 22AWG GRN 12"	6000-02221	UL1430 SURFACE MARKED
4	1	WIRE 22AWG WHT 12"	6000-02222	UL1430 SURFACE MARKED
3	4	TIE CABLE 1/16-3/4"	2800-01452	RICHD WIT-18R
2	10	CRP TERM 18-24 AWG	2000-01132	MOLEX DB-50-0105
1	2	HSG TERM 5 PIN W/LCK	2100-04871	MOLEX 22-DI-2057
ITEM	QTY	DESCRIPTION	CORVUS PN	MFG PN

PARTS LIST

1 PERMANENTLY MARK PART NO. AND REVISION LEVEL USING BLK EPOXY INK ON ITEM 8 ,

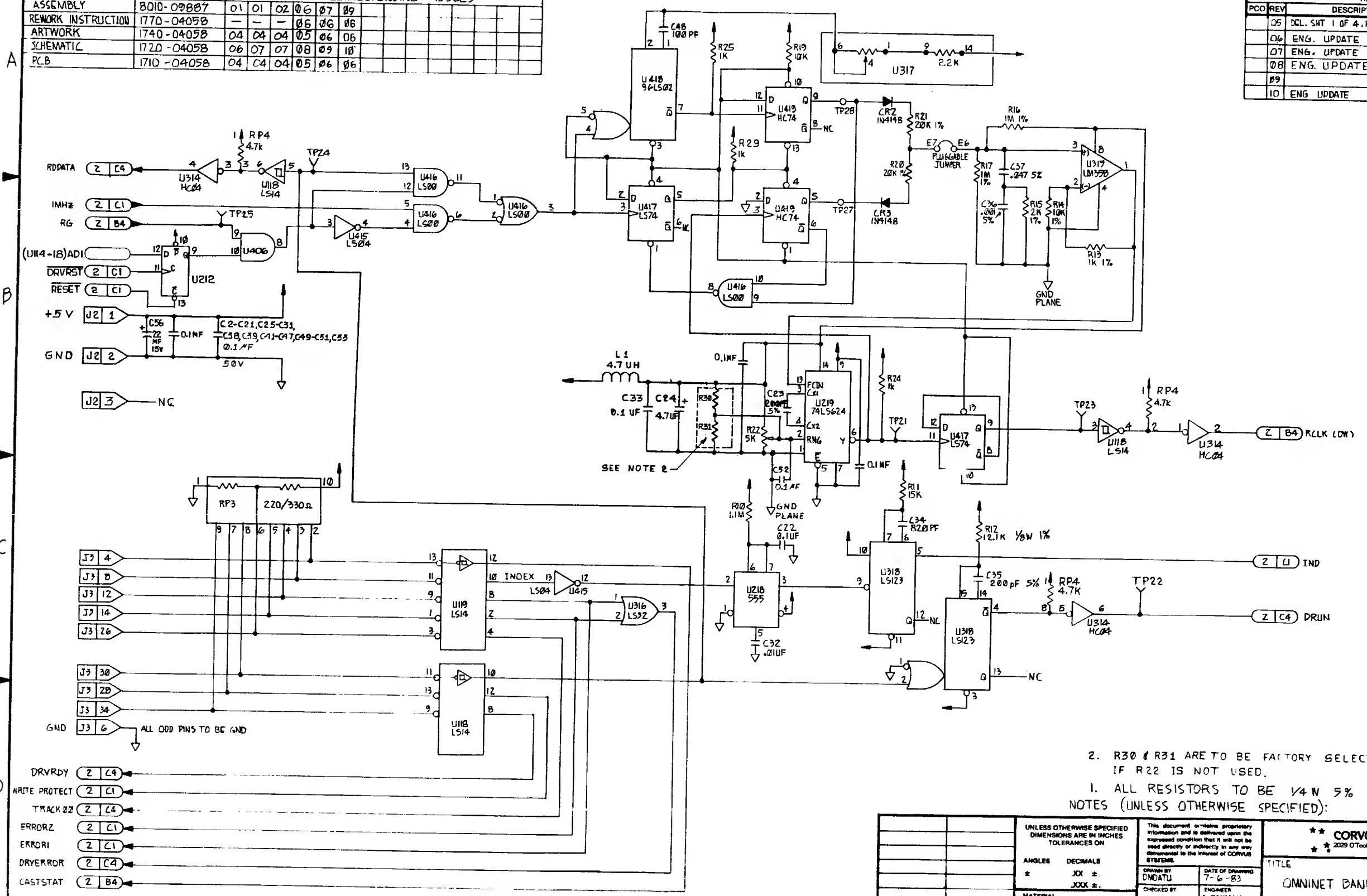
NOTES:

<div>8010-09779</div> <div>NEXT ASSY</div> <div>APPLICATION</div>		<div>BANK</div> <div>USED ON</div> <div>FINISH</div>	<div>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON</div> <div>ANGLES    DECIMALS</div> <div>±            .XX ±.</div> <div>              .XXX ±.</div>	<div>This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS</div>		<div>★ ★ CORVUS SYSTEMS</div> <div>★ ★ 2029 O'Toole Avenue, San Jose, CA 95131</div>		
				<div>DRAWN BY</div> <div>DMDATLI</div>	<div>DATE OF DRAWING</div> <div>5-16-83</div>	<div>TITLE:</div> <div>CABLE ASSY, LED BOARD, BANK</div>		<div>REV:</div> <div>A</div>
				<div>CHECKED BY</div> <div><i>[Signature]</i></div>	<div>ENGINEER</div> <div><i>[Signature]</i></div>	<div>ASSY. DWG.</div> <div>8015-09700</div>		
				<div>APPROVED</div> <div><i>[Signature]</i> 11/18/83</div>		<div>APPROVED</div> <div></div>		<div>SCALE</div> <div>NONE</div>

**APPENDIX G**  
**SCHEMATIC DRAWINGS**

DRAWING	NUMBER	CORRESPONDING ISSUES						BLOCK					
ASSEMBLY	8010-00007	01	01	02	06	07	09						
REWORK INSTRUCTION	1770-04058	-	-	-	06	06	06						
ARTWORK	1740-04058	04	04	04	05	06	06						
SCHEMATIC	1720-04058	06	07	07	08	09	10						
PCB	1710-04058	04	04	04	05	06	06						

PCO	REV	DESCRIPTION	DATE	APPROVED
05	DEL. SMT 1 OF 4, REWORK SMT 143		7-11-83	
06	ENG. UPDATE		7-19-83	
07	ENG. UPDATE		8-23-83	
08	ENG. UPDATE	MCO 122	8-31-83	
09		MCO 133	10-12-83	6C
10	ENG. UPDATE	MCO 150	1-17-84	HB

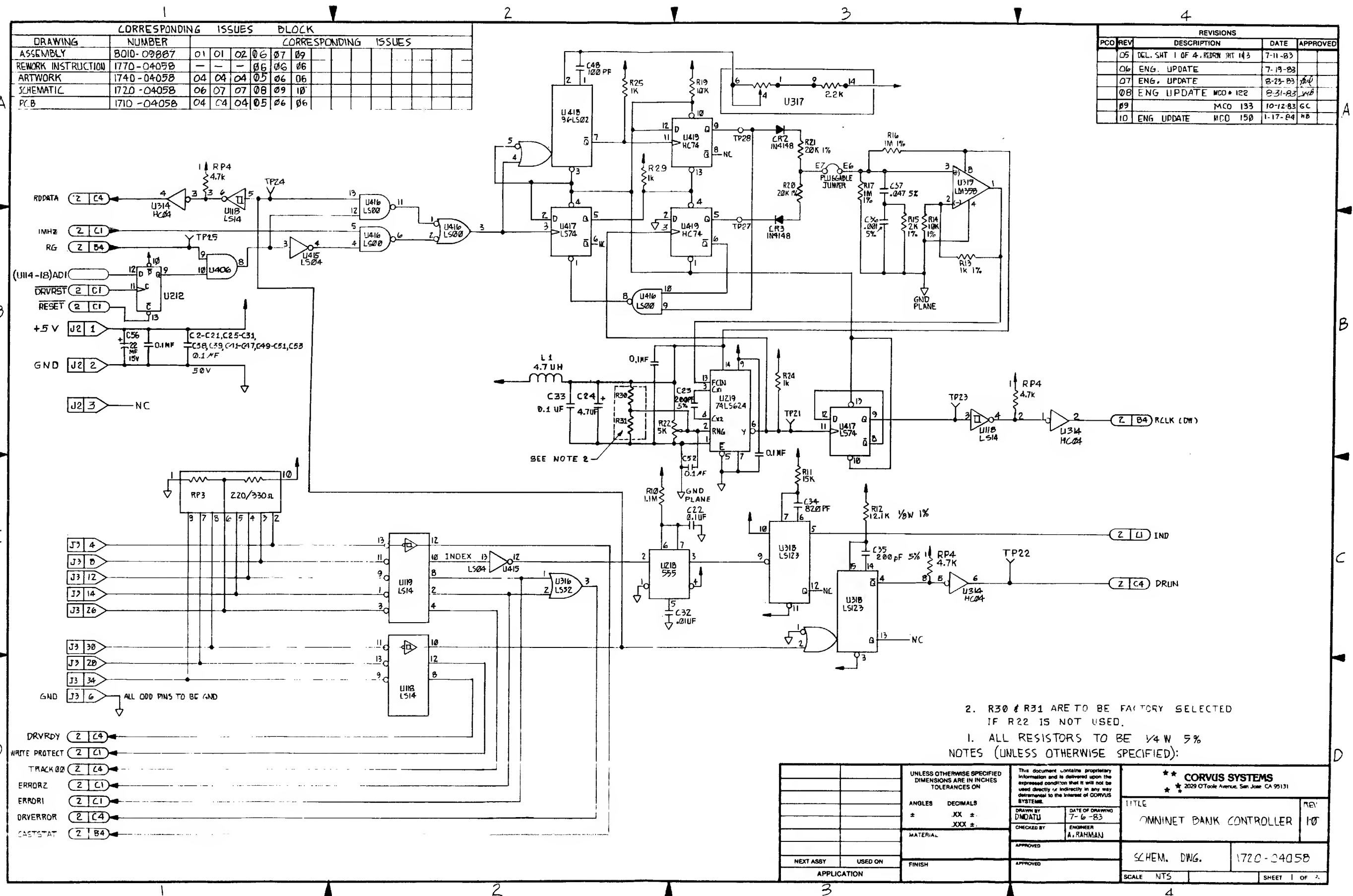


2. R30 & R31 ARE TO BE FACTORY SELECTED IF R22 IS NOT USED.

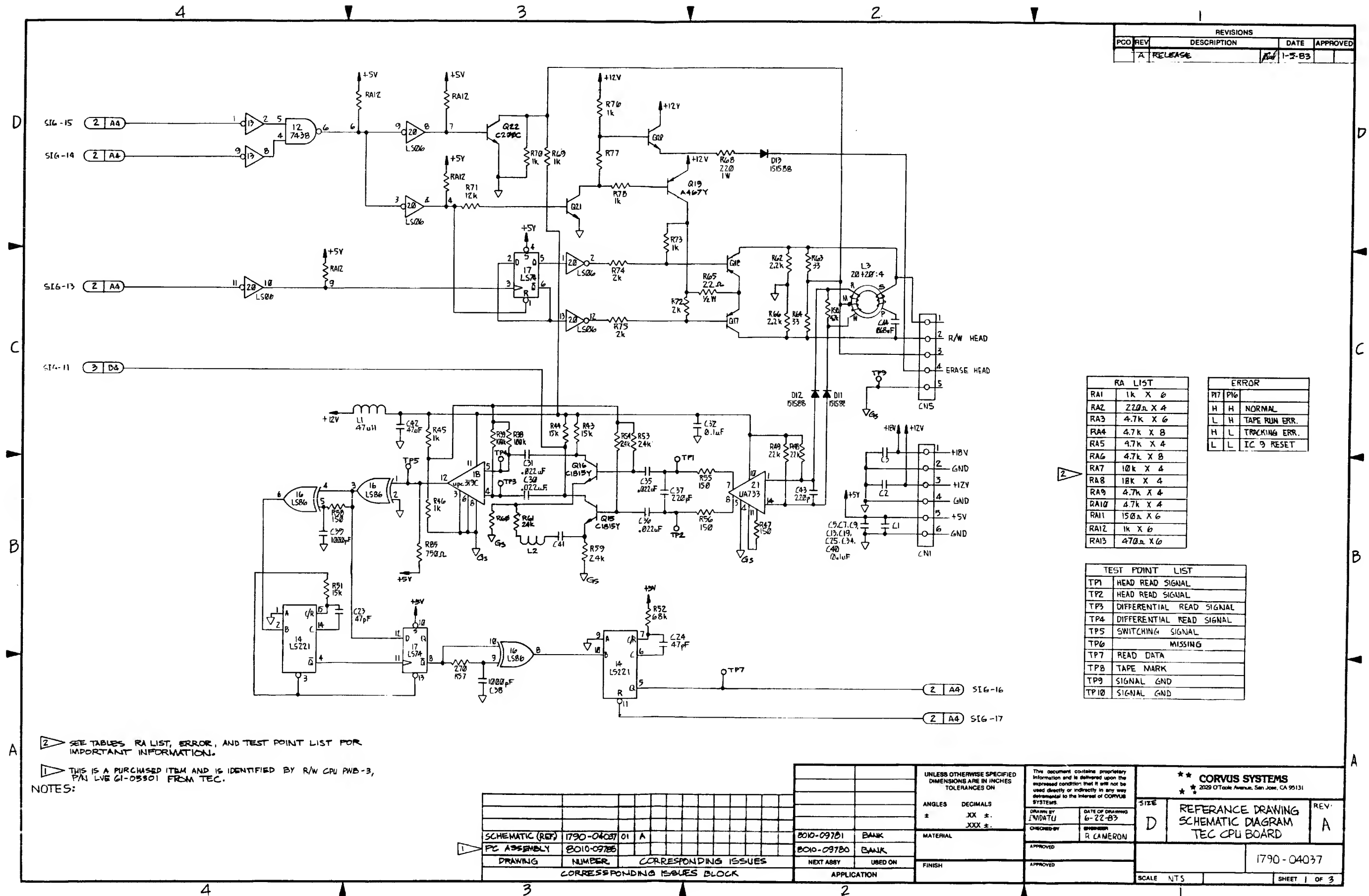
1. ALL RESISTORS TO BE 1/4 W 5%  
NOTES (UNLESS OTHERWISE SPECIFIED):

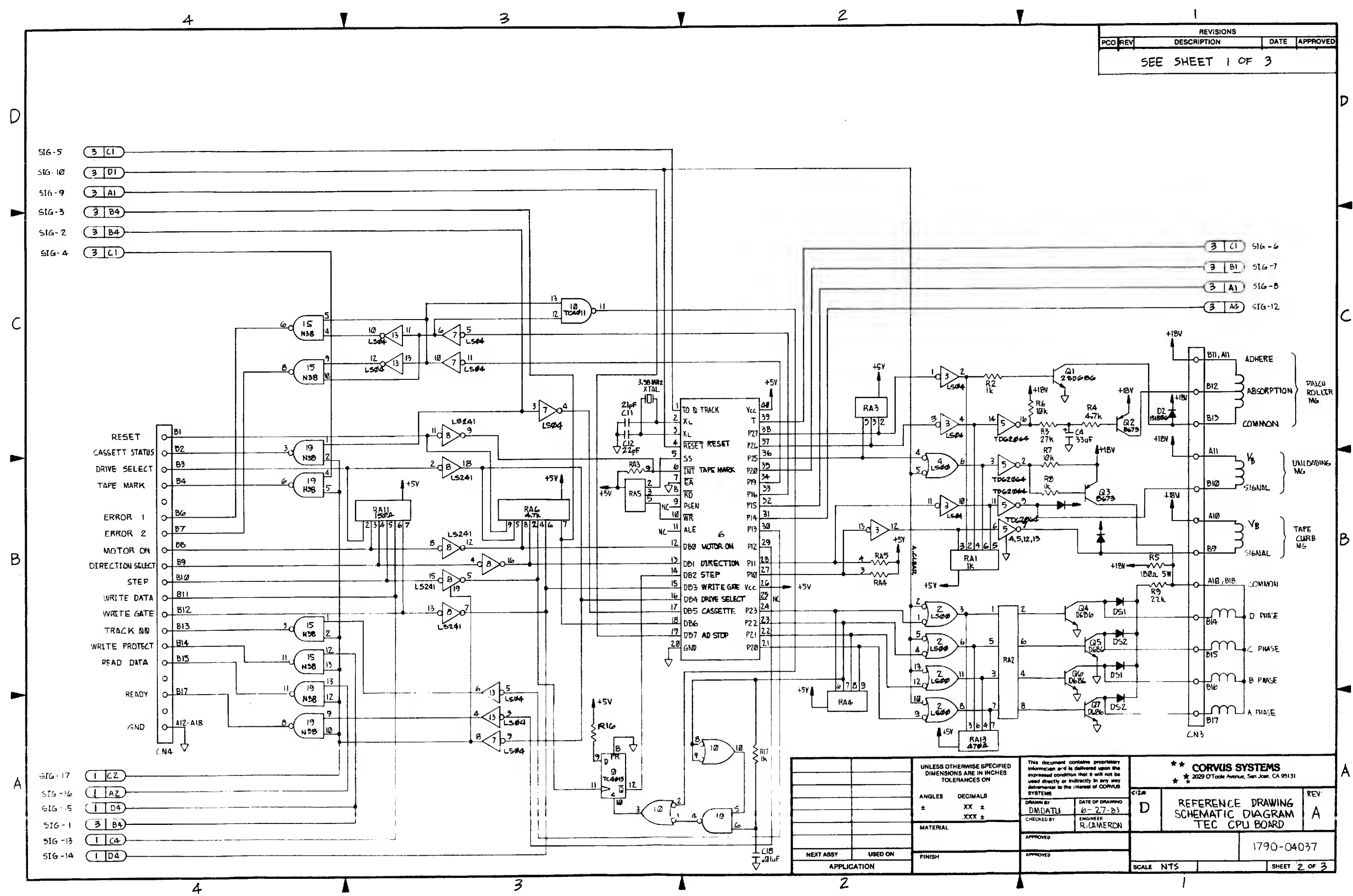
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON		THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND IS DELIVERED UPON THE EXPRESSED CONDITION THAT IT WILL NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETERIMENTAL TO THE INTERESTS OF CORVUS SYSTEMS.		★ ★ CORVUS SYSTEMS ★ ★ 2020 O'Toole Avenue, San Jose, CA 95131	
ANGLES	DECIMALS	DRAWN BY	DATE OF DRAWING	TITLE	REV
±	.XX ±	DMOATU	7-6-83	OMNINET BANK CONTROLLER	10
	.XXX ±	CHECKED BY	ENGINEER	SCHEM. DWG.	1720-04058
			A. RAHMAN	SCALE	NTS
NEXT ASSY	USED ON	APPROVED			SHEET 1 OF 3
APPLICATION	FINISH	APPROVED			





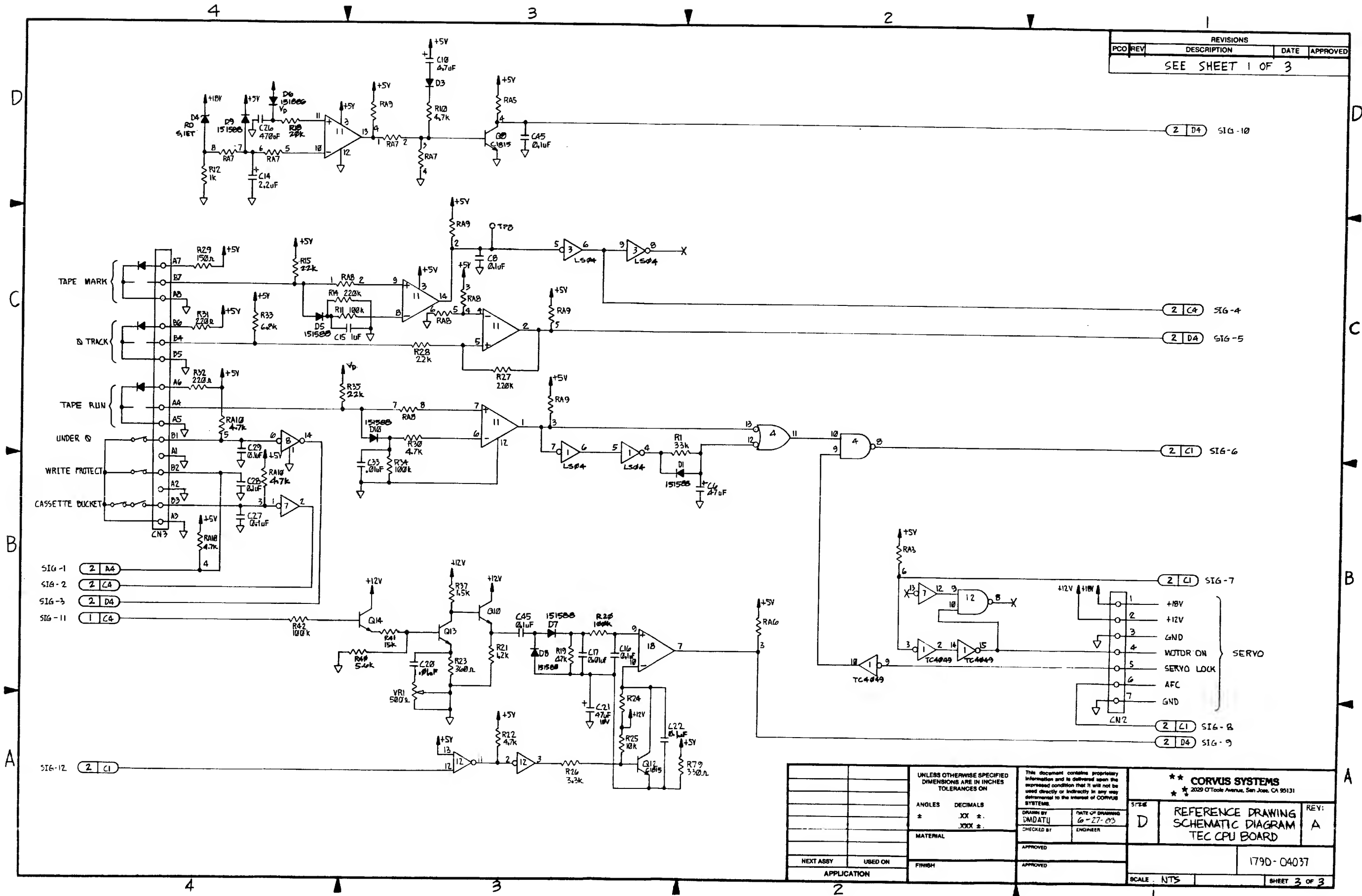






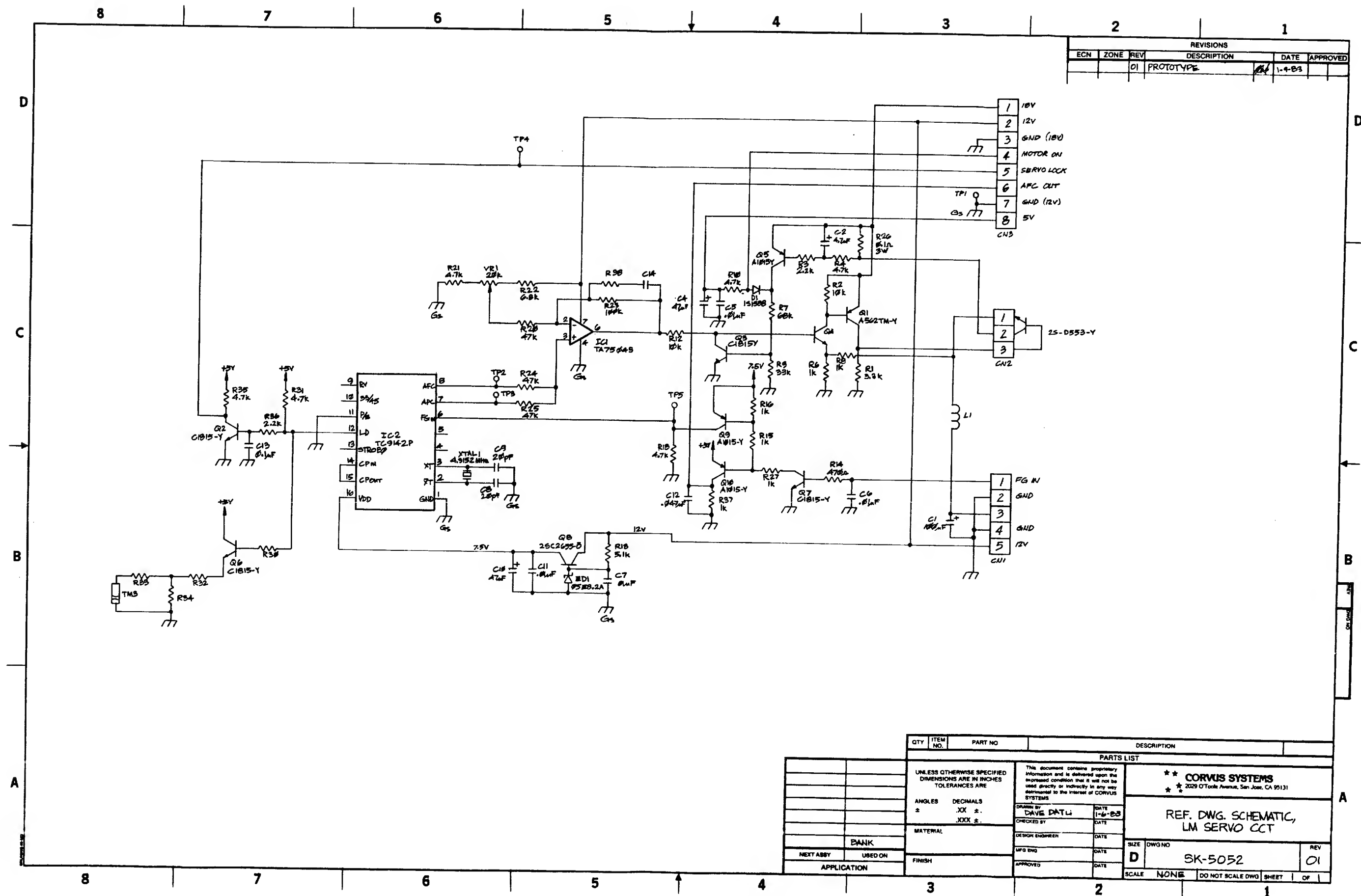
REVISIONS			
PCO REV	DESCRIPTION	DATE	APPROVED
SEE SHEET 1 OF 3			

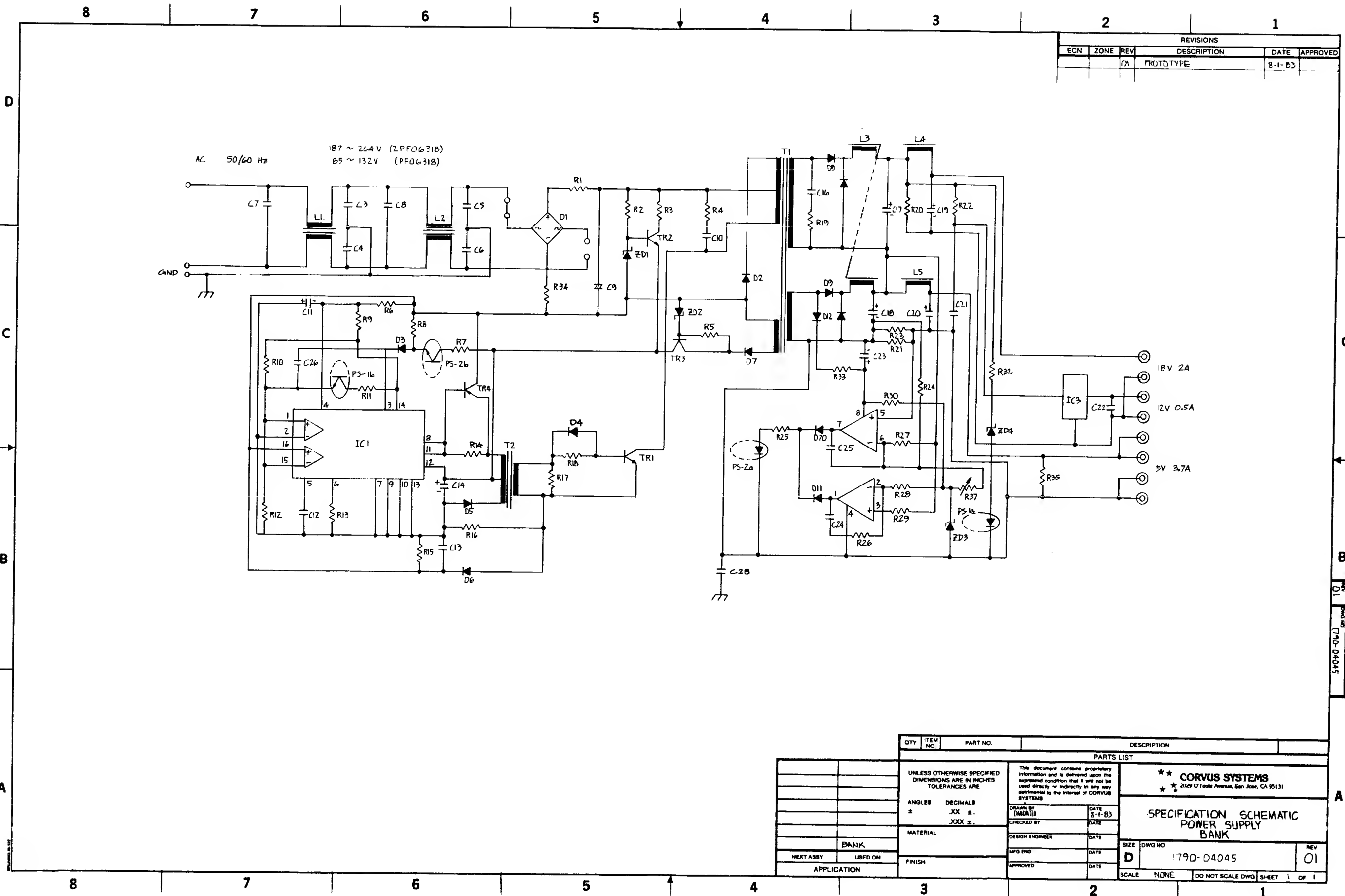
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			ANGLES    DECIMALS ±           XX ± XXX ±	DRAWN BY DMOATU	DATE OF DRAWING 6-27-83	D	REFERENCE DRAWING SCHEMATIC DIAGRAM TEC CPU BOARD
		MATERIAL	CHECKED BY R. CAMERON	ENGINEER R. CAMERON			
			APPROVED				
NEXT ASSY	USED ON	FINISH	APPROVED			1790-04037	
APPLICATION					SCALE   NTS		SHEET   2 OF 3



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ANGLES	DECIMALS	DRAWN BY	DATE OF DRAWING
±	.XX ±	DMADATU	6-27-83
	.XXX ±	CHECKED BY	ENGINEER
MATERIAL		APPROVED	
FINISH		APPROVED	
NEXT ASSY	USED ON	CORVUS SYSTEMS 2029 O'Toole Avenue, San Jose, CA 95131	
APPLICATION		REFERENCE DRAWING SCHEMATIC DIAGRAM TEC CPU BOARD	
		179D-04037	
		SHEET 3 OF 3	





REVISIONS				
ECN	ZONE	REV	DESCRIPTION	DATE
		01	PROTOTYPE	8-1-83

QTY		ITEM NO	PART NO.		DESCRIPTION							
PARTS LIST												
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE			This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS			☆☆ CORVUS SYSTEMS ☆☆ 2029 O'Toole Avenue, San Jose, CA 95131						
						ANGLES		DECIMALS		SPECIFICATION SCHEMATIC POWER SUPPLY BANK		
						±		.XX ±.				
								.XXX ±.				
MATERIAL				DRAWN BY (DMADU)		DATE 8-1-83						
				CHECKED BY		DATE						
				DESIGN ENGINEER		DATE						
				MFG ENG		DATE						
				APPROVED		DATE						
BANK				SIZE		DWG NO		REV				
NEXT ASSY		USED ON		D		1790-D4045		01				
APPLICATION				FINISH								
						SCALE NONE		DO NOT SCALE DWG SHEET 1 OF 1				